RADIOLOGY

A MONTHLY JOURNAL DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

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GENERAL INFORMATION

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Studies on the Value of Serial Films in Estimating the Progress of Pulmonary Disease[1]

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IT HAS BEEN generally accepted that serial chest roentgenograms made at intervals of two or three months permit valid conclusions as to the presence of change or activity in a majority of cases of chronic pulmonary disease. In the 1940 issue of "Diagnostic Standards" published by the National Tuberculosis Association, the following pertinent sentences appear: "In clinical cases requiring a period of observation for accurate judgment, serial roentgenograms of the chest are most important.... The value of serial roentgenograms to help determine the seriousness of the lesions and the kind of treatment or observation required can hardly be over-emphasized." The recently published 1950 edition of that manual carries the statement: "*Serial roentgenograms* over a period of weeks to determine the degree of instability of lesions... *have value in determining whether a lesion is active and in need of treatment.*" The importance of testing the apparent usefulness of such serial films is therefore quite evident. The present paper is a report of a study of serial roentgenograms in estimating the progress of pulmonary disease.

The investigation was designed to determine how consistent were the interpretations of two postero-anterior roentgenograms of the chest made three months apart in a series of patients with established pulmonary tuberculosis. The interpretations were made on the roentgen findings alone, without reference to clinical or laboratory data. A consecutive pair of films for each of 150 patients was chosen by independent observers for this work, thereby providing 300 standard 14 × 17-inch films for review. All the markings on the films were covered or removed, and a new numbering system was used to identify the sequence of the films in any given test. The six readers who undertook this study knew only which was the first and which was the second film of any pair. After an interval of several weeks, and without the record of the results of the first readings, the same films were re-interpreted by all six readers, thus providing a total of 12 independent interpretations on each set of the entire group. This permitted examination of the consistency of interpretation of each reader with himself (*intra*-individual consistency or variation),

[1] From the Divisions of Radiology and Medicine, Stanford University Medical School and the University of California Medical School, San Francisco; the E. V. Cowell Memorial Hospital and the Alta Bates Hospital, Berkeley; and the Division of Biostatistics, School of Public Health, University of California. Presented at the Thirty-seventh Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 2–7, 1951.

This paper is a companion report to one currently appearing in the *American Review of Tuberculosis*. It embodies roentgenographic observations and other material not included in that paper, which presents data on procedure and statistics in greater detail.

and of each reader with the other five readers (*inter*-individual consistency or variation). The interpreters were a group of three radiologists and three chest specialists, all of relatively extensive experience in chest roentgenology. The three radiologists had previously had considerable experience in group study on the "error" problem; one of the three chest specialists also had taken part in such research, while the remaining chest specialists were men of recognized ability in their field.[2] The entire study was made over a period of approximately twelve months.

In order to develop a common language, the group made three preliminary sets of readings and held several conferences on the findings thereof. As a result of these conferences, the following arbitrary decisions were agreed upon:

1. The term "better" (applied to the second roentgenogram) meant that the reader interpreted decrease in the area of disease, decrease in the general density or volume of disease, or decrease in the size of a cavity. Increase in density of small infiltrates—presumably due to fibrosis or calcification—could also mean improvement.

2. The term "no change" meant "no significant change in the apparent extent or nature of the lesion or lesions."

3. The term "worse" meant that the reader interpreted the film as showing the presence of extension of disease or new areas of disease, with or without decrease in pre-existing areas. If a film showed coalescence of multiple small cavities to form a large one, it was decided to classify it as "worse." If a cavity decreased in size but the extent of any associated pulmonary infiltration increased, this was to be regarded as "worse."

MATERIAL

In order to secure a representative sample of material, it was decided to select films from four different institutions in which patients were being treated for pulmonary tuberculosis. Sixty pairs of films were chosen from a public sanatorium which admits mainly patients with chronic disease; 47 pairs were selected from a central agency through which a streptomycin study was being conducted; a set of 27 pairs came from a county hospital for the care of active cases of tuberculosis; 16 pairs were obtained from a private sanatorium. In all instances (except the streptomycin study cases) the attempt was made to secure films from consecutive admissions.

The roentgenograms were selected by an independent radiologist in cooperation with the biostatistician who guided the investigation. After the conclusion of the study, it was agreed by the participating radiologists and chest specialists that the roentgenograms were reasonably *representative of films seen in everyday clinical practice* dealing with the diagnosis and treatment of pulmonary tuberculosis.

PRELIMINARY TRIALS

The preliminary trials have been described in another publication (9). Suffice it to say here that categories more refined or more detailed than the three elementary ones of "worse," "no change," and "better" resulted in increasing inconsistency and

[2] The qualifications of the readers are as follows:

Garland is Clinical Professor of Radiology at Stanford University Medical School; consultant in radiology to the U. S. Veterans Administration, Armed Forces Institute of Pathology, and other official bodies; Past Examiner on the American Board of Radiology; Past President of the Radiological Society of North America.

Miller is Professor of Radiology at the University of California Medical School, San Francisco; consultant in radiology to the U. S. Veterans Administration and other hospitals in Northern California.

Zwerling is radiologist to the Alta Bates Hospital in Berkeley, Calif.; consultant radiologist to U. S. Public Health Service; and author of several papers dealing with chest radiological diagnostic problems.

Harkness is senior attending physician at the E. V. Cowell Memorial Hospital, University of California, Berkeley; director of the Alameda County Tuberculosis Association; and author of papers dealing with chest film interpretation.

Hinshaw is Clinical Professor of Medicine at Stanford University Medical School, consultant in diseases of the chest to the U. S. Veterans Administration; Past Associate Professor of Medicine at the Mayo Foundation; Past President of the American Trudeau Society, etc.

Shipman is Clinical Professor of Medicine at the University of California, chief of the tuberculosis service, Outpatient Department, University of California Hospital; consultant to the U. S. Veterans Administration Hospital and the U. S. Marine Hospital; President-elect of the National Tuberculosis Association, etc.

Serial Film Study

Date _____ Reading: 1st _____ 2nd _____ Reader _____

Progress of Disease as Evidenced by Serial X-Rays (CHECK ONE)

	BOTH LUNGS			RIGHT LUNG			LEFT LUNG			COMMENTS
Film No.	Worse	No Change	Better	Worse	No Change	Better	Worse	No Change	Better	

Fig. 1. Check sheet used in this study (in actual use, the sheet had 25 entry lines). The 150 films were divided into three sets of 50 each and were circularized among the six readers for individual reading. As soon as a reader had interpreted his set of 50 pairs, he forwarded the films to the next reader, and mailed his interpretation to the biostatistician. The reader kept no record of his interpretations and did not receive the same set of films for re-reading until a period of about six weeks had elapsed.

were therefore abandoned for this particular study. Because the changes sometimes present in one lung showed a marked disparity from those taking place in the other, *it was decided that in the final study, each reader would express his opinion in three sections: first, based on the film as a whole, and then separately for changes in the right lung and in the left lung* (Fig.1).

RESULTS

The results of the various interpretations will be considered first from the reports based on examination of the entire lung field. Of the entire set of 150 pairs of films, each read twice (by each of six readers), the mean of the interpretations of "better" was 59, "no change" 66, and "worse" 25. However, the range of interpretation of "better" was from 39 to 74. That is, one reader read 39 of the pairs as disclosing improvement, while another read 74 (or almost twice as many) as showing improvement. Similar inconsistencies were found for the interpretations "no change" (the range of which was 52 to 91) and "worse" (with a range of 20 to 33). See Table I.

In order to determine whether the variations existed only in some of the readers, the interpretation given by each reader on each pair of films was compared with that given on the same pair by the same or a different reader. All six readers were found to show a significant degree of inconsistency with themselves and with each other. The pair of readers who agreed best still disagreed on 38 cases. The pair of readers who agreed least, disagreed on 56 cases. The least intra-individual or personal inconsistency was exhibited by Reader F, who disagreed with himself in 25 out of the 150 pairs; the highest inconsistency rate was for Reader B, who disagreed with himself in 43 of the 150 pairs. All six readers exhibited a fairly close inter-individual disagreement rate (Table II).

In order to obtain an estimate of the

TABLE I: SERIAL FILM EVALUATION. VARIATION IN INTERPRETATION OF 150 SETS OF CHEST FILMS IN TWO INDEPENDENT READINGS

(Interpretation based on both lung fields)

Reader	Reading	Second Film Diagnosed as			Total
		"Better"	"No Change"	"Worse"	
A	1st	68	56	26	150
	2nd	57	69	22	148*
B	1st	62	55	33	150
	2nd	74	52	24	150
C	1st	69	52	29	150
	2nd	70	35	20	145*
D	1st	65	58	27	150
	2nd	57	69	24	150
E	1st	39	91	20	150
	2nd	49	81	20	150
F	1st	52	75	23	150
	2nd	49	74	27	150
Range		39–74	52–91	20–33	
Mean		59.3	65.5	24.6	

* The difference between these figures and 150 is accounted for by films which a reader regarded as of inadequate diagnostic quality.

TABLE II: NUMBER OF DISAGREEMENTS OF EACH READER WITH HIMSELF AND WITH EACH OF THE OTHER FIVE READERS IN INTERPRETING 150 FILM PAIRS

(Diagnosis based on whole lung field; comparison between readers based on first readings only and comparison of each reader with himself based on both readings)

Reader	Number of Disagreements of Reader					
	A	B	C	D	E	F
A	*33*	44	38	47	55	49
B	44	*43*	42	52	56	50
C	38	42	*29*	46	53	48
D	47	52	46	*32*	55	48
E	55	56	53	55	*30*	42
F	49	50	48	48	42	*25*
Mean No. of disagreements with other readers	46.6	48.8	45.4	49.6	52.2	47.4

percentage of disagreement which may be expected between two readers when they interpret serial films, all the material available in the present study can be utilized. For each pair of films there are available four comparisons for any two readers. For example, the first reading of Reader A can be compared to the first and second readings of Reader B, and the second reading of Reader A can similarly be compared to the first and second readings of Reader B. There are 15 ways for pairing the six readers against each other. Thus, there is available for every pair of films a total of 60 comparisons of one reader against another. For the entire group of 150 pairs of films there is available a total of 60×150, or 9,000 comparisons.[3] The magnitude of inconsistency in interpretation can be obtained by dividing the number of comparisons which resulted in disagreement by the total number of comparisons. Thus, in the 8,931 usable comparisons, there were 6,245 instances in which the same symbol was used by two readers and 2,686 in which there was disagreement. There was, therefore, a 30.1 per cent disagreement between readers.

The ability of a reader to be consistent with himself in interpreting serial films can be determined in a similar way. For each pair of films there are available six comparisons of a reader with himself obtained by comparing the first and second readings of each reader. The 150 pairs of films provide, therefore, 900 intra-individual comparisons.[4] The number of

[3] There were not exactly 9,000 comparisons because occasionally a reader found a pair of films of non-diagnostic quality. These comparisons were left out. The total number of usable comparisons was 8,931.

[4] There were actually 893 usable comparisons.

TABLE III: PER CENT DISAGREEMENTS BETWEEN READERS (INTER-INDIVIDUAL) AND WITHIN READERS (INTRA-INDIVIDUAL) IN INTERPRETING 150 FILM PAIRS

(Diagnosis based on whole lung field)

Comparisons	Inter-Individual	Intra-Individual
Disagreements	2,686 (30.1%)	192 (21.5%)
Agreements	6,245 (69.9%)	701 (78.5%)
TOTAL	8,931 (100.0%)	893 (100.0%)

these which are in disagreement divided by the total number of comparisons provides an estimate of a reader's chances of disagreeing with himself. These are shown in Table III.

From Table III the first main result of the study can therefore be stated as follows: In judging a pair of films for evidence of progression, regression or stability of disease (based on the entire lung field) *two readers are likely to disagree with each other in nearly one-third of the cases and a single reader is likely to disagree with himself in about one-fifth of the pairs.*

GROUP OPINION

Because of the variation in interpreting serial films, it cannot easily be determined what the probable change status is of the film pairs that have been studied. In other words, how many of the 150 film pairs show evidence of improvement, how many indicate deterioration, and how many represent stability. One method of obtaining an estimate of these figures is to use group opinion, that is, to consider the designation given most often in the 12 readings available for each pair as the one most likely to be correct. With this procedure, each reading of each reader is given equal weight to that of every other reading of the same or another reader.

The distribution of the 150 film pairs under this assumption is shown in Table IV. In this table the 150 film pairs are distributed according to the total number of identical readings which were obtained in the 12 interpretations that were made for each. Thus, a film pair which was diagnosed the same by all six readers in all the readings will have 12 identical readings. One in which 11 of the readings were identical, with only a single reader placing it in a different category in one of his readings, will have 11 identical readings, and so on. The least number of identical readings possible is 4, since there were 12 readings and 3 categories. There were 38 pairs in which the 12 readings were identical; 28 had 11 identical readings, and in 17 pairs 10 of the readings were identical. Thus, in 83, or more than one-half of the film pairs, there were at least 10 identical readings, while for the remaining 67 cases there were at most 9 identical readings.

TABLE IV: DISTRIBUTION OF 150 PAIRS OF FILMS ACCORDING TO THE MAXIMUM NUMBER OF IDENTICAL READINGS OUT OF 12

(Diagnosis based on entire lung field)

Number of Identical Readings	Total	Major Symbol		
		Better	No Change	Worse
12	38	16	13	9
11	28	11	16	1
10	17	6	8	3
9	19	6	10	3
8	19	7	10	2
7	12	7	5	0
6	13*	3	3	1
5	4†	2	0	1
Total	150‡	58	65	20

Total number of disagreements	2,874
Total number of paired comparisons	9,814
Per cent disagreement (inter- and intra-individual)	29.1

* Including 6 films in which the major symbol was indeterminate. (In 4 of these the readings were: 6NC, 6B; in 2 of them the readings were: 6 NC, 6W.)

† Including one film in which the major symbol was indeterminate (5W, 5B)

‡ Including the 7 films described above*†.

APPARENT INFLUENCE OF TECHNIC ON RESULTS

A clue to the influence of radiographic technic on inconsistency in interpretation was obtained by noting the comments pertaining to quality of film after certain readings. The readers were asked to note films of poor technical nature or of poorly comparable quality. The films were then sorted into two groups: those on which no reader recorded technical troubles and those on which one or more readers noted technical faults of some type.

There were 101 film pairs of the first type and 49 of the second.

The percentage disagreement between readers (inter-individual) on the "good technic" pairs was 26.6 and on the "poor technic" pairs 37.0. The disagreement among readers themselves (intra-individual) averaged 20.5 per cent on the "good" pairs and 23.6 per cent on the "poor" pairs. These figures are based on readings of the entire lung fields, and indicate that with serial films of good comparable quality a significant reduction in the degree of reader inconsistency is obtained.

APPARENT INFLUENCE OF EXTENT OF DISEASE ON RESULTS

At the beginning of this study, it was suspected that bilateral lesions would prove a larger source of error than unilateral ones, especially since progress of disease in one lung might be paralleled by regression in the other. Therefore, separate columns were made available for recording interpretations of each lung, as well as for the entire chest.

Of the 150 film pairs, there were 22 on which no lesion was shown on the left side and 11 in which no lesion was demonstrated on the right side. Consequently, the total number of film pairs showing a lesion on the left side was 128 and the total number showing a lesion on the right side was 139. These provide material for estimating the probability of disagreement in judging progress of a lesion separately for the right lung and for the left lung. Of the 8,280 comparisons which were available on the 139 pairs of films showing a lesion on the right side, 2,440 were disagreements. The percentage of disagreement, therefore, was 29.5. Similarly, the readers disagreed with one another in judging the lesion on the left side 28.5 per cent of the times. These figures were only slightly lower than the 30.1 per cent disagreement found among the same readers in evaluating the progress of the lesion as judged from the entire lung field. From this it may be concluded that the disagreements in serial film interpretation in this series are not due chiefly to film pairs in which contradictory evidence is produced by the two lungs, for the percentage disagreement was almost as high when judgment was made on only one of the lungs.

The same conclusion is justified when intra-individual variation is considered, for here also the probability of a reader disagreeing with himself in judging progression on a single lung field is only slightly lower than in evaluating the entire lung field.

APPARENT INFLUENCE OF SPECIALTY ON RESULTS

Since the two specialties of radiology and phthisiology were equally represented among the six readers participating in this study, it was thought of interest to compare the performances of the two groups. In so doing it was not the intention to imply that differences herein observed necessarily reflect those of the two specialties. Obviously the three radiologists participating in this study do not claim to be a "representative sample" of all radiologists; nor is the performance of the three phthisiologists necessarily characteristic of all members of their specialty. Nevertheless, the comparison might be instructive if only for the purpose of stimulating similar comparisons in other studies.

Of immediate interest is a comparison of the group performance of the three chest specialists with that of the group composed of the three radiologists. In attempting to obtain such a comparison it becomes necessary to define a method for obtaining group interpretation on a pair of films. For present purposes this was accomplished by using majority opinion of the group of three. In other words, if a film pair was interpreted by a certain symbol in four or more (out of six) readings of the radiologists it was so considered as representing the opinion of the radiologists. Similarly, if a film pair was denoted in four or more of the six readings of the chest specialists as falling in one of the three categories, that category was

TABLE V: COMPARISON OF GROUP PERFORMANCE OF CHEST SPECIALISTS AND RADIOLOGISTS

Distribution of Film Pairs According to the Category Used in Four or More Readings of Phthisiologists Against That Used in Four or More Readings of Radiologists. (Diagnosis based on entire lung field)

Chest Specialists Group Opinion on Category	Number of Films with 4 or More Agreements	Radiologists Group Opinion on Category: Number of Films with 4 or More Agreements — Better	No Change	Worse	Number of Films with 3 or Fewer Agreements	Total Film Pairs (Chest Specialists)
	Better	36	13	2	10	61
	No Change	0	48	0	2	50
	Worse	1	2	17	1	21
	Number of Films with 3 or Fewer Agreements	4	8	1	5	18
		41	71	20	18	150
		Total Film Pairs (Radiologists)				

taken to represent the opinion of those specialists on that film pair. It is not possible by this method, however, to obtain a group opinion on each film, for in certain cases there was no agreement in as many as four readings by a given group. These represent an indeterminate category for the group.

Table V presents a comparison between the interpretations of the radiologists and those of the phthisiologists. A number of interesting points appear from this table. To consider first the marginal totals, it appears that the radiologists as a group distributed the 150 film pairs in the various categories differently than did the chest specialists. The main difference is that *phthisiologists were more inclined to interpret improvement in two films than were the radiologists, while the latter were more likely to diagnose stability or no change in the film pair than were the chest specialists.* The phthisiologists as a group placed 61 films in the "better" category as against 41 put in the same category by the radiologists. On the other hand, only 50 film pairs were considered by the phthisiologists to exhibit "no change," while the radiologists recorded 71 such pairs.

In 101 film pairs there was agreement in the group opinion of radiologists and phthisiologists. In 36 of these the two groups agreed that the film pair was in the "better" category. In 48 there was agreement for "no change," and 17 pairs were placed in the "worse" category by each group. In 5 cases no group agreement could be obtained on a definite classification of the film pair, either by the three radiologists or by the three chest specialists. In the remaining 45 cases the film pairs were put in different categories by the two groups. The greatest divergence was found in cases where the radiologists as a group considered the film pairs to exhibit "no change." Of the 71 cases in this category, the chest specialists agreed that there had been "no change" in only 48 cases; in 13 they thought that the lesion was "better"; in 2 that it was "worse"; and in 8 no agreement was reached. On the other hand, when the phthisiologists considered a film pair as exhibiting "no change," the radiologists almost always placed the film in the same category. Differences were noted also on the 61 film pairs which the phthisiologists considered as showing improvement. In these cases the radiologists concurred in only 36 instances; in 13 they gave the classification of "no change"; in 2 they considered the same films as showing evidence of "worse"; and in 10 instances no agreement could be obtained by a majority of the radiologists.

TABLE VI: INTER-INDIVIDUAL AND INTRA-INDIVIDUAL DISAGREEMENT WHEN THE THREE PHTHISIOLOGISTS WERE COMPARED WITH EACH OTHER, WHEN THE THREE RADIOLOGISTS WERE COMPARED WITH EACH OTHER, AND WHEN EACH PHTHISIOLOGIST WAS COMPARED WITH EACH RADIOLOGIST

(Diagnosis based on entire lung field)

Type of Comparison and Specialty of Readers	Per Cent Disagreement
Inter-Individual	
All Pairs	30.1
Phthisiologists	27.1
Radiologists	29.2
Phthisiologists and Radiologists	31.4
Intra-Individual	
All Pairs	21.5
Phthisiologists	23.7
Radiologists	19.3

It may be noted that there were 3 instances in which there was complete divergence or reversal of opinion by the two groups. For 2 film pairs the radiologists as a group considered the lesion as "worse" while the chest specialists as a group thought it was "better." In the other case the reverse situation occurred: the radiologists considered the case "better" and the phthisiologists "worse." These 3 film pairs, together with the 5 mentioned previously in which neither the radiologists nor the chest men could agree on a single classification, are without a doubt the most difficult in this set of films. They were subsequently reviewed in conference by all six readers, and in most instances the disagreements persisted even after considerable discussion.

It may also be of interest to determine the inter- and intra-individual variation in interpreting serial films separately for the two groups. This information is shown in Table VI. It will be seen that the phthisiologists were somewhat less likely to differ with one another than were the radiologists, but the inconsistency of an individual reader with himself (intra-individual variation) was smaller for the radiologists than for the chest specialists. Thus, a phthisiologist disagreed in 27.1 per cent of comparisons with another chest specialist, while a radiologist disagreed with another radiologist in 29.2 per cent of the cases. The greatest variation was found when the readings of a phthisiologist were compared with those of a radiologist. Percentage disagreement in this case was 31.4. On the other hand, a phthisiologist contradicted himself in 25.7 per cent of his readings, while a radiologist contradicted himself in 19.3 per cent of his interpretations.

ILLUSTRATIVE EXAMPLES

The reaction of many specialists to reports of the comparatively large "error" factor in chest studies is: "Well, this would not happen to me, especially with ordinary films." To illustrate the cases in which the investigators in the present study were in agreement or disagreement, and perhaps to attempt convincing a few of the skeptics, several roentgenograms are reproduced here. Those of the first group (Figs. 2–4) are from cases in which complete agreement was obtained; the remainder (Figs. 5–10) from those cases in which disagreement occurred. The former may be classified as "easy" films, and the latter as "difficult."

Doubtless, in sound clinical practice, some of these "difficult" cases would have been given the benefit of *complete* roentgenographic examination after the second films had been interpreted as showing questionable changes or after disagreement had been manifested between consultants. In this way, major disagreement might have been resolved. However, it is well known that such complete examination is not always performed, and therefore decisions would be made as a result of comparison of single postero-anterior films alone. The illustrations reveal the degree of variation resulting in some such cases.

It should be noted that identification of films as being "easy" or "difficult" was not readily accomplished. Such films were not identified in our preliminary trials. After completion of the main study, it was the impression of our statistical analyst (Yerushalmy) that on first readings the "difficult" pairs were not distinguishable from "easy" ones. It was only after the films had been interpreted more than once that it was possible to separate out those

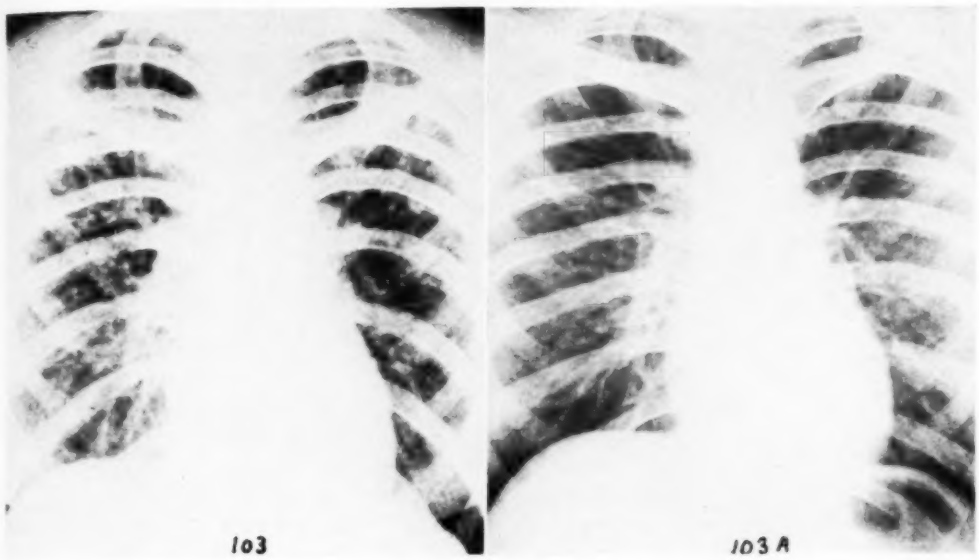

Fig. 2. Case 103. *Agreement.* All 12 interpretations recorded the findings on the second films as *better.* The bilateral pulmonary infiltration is obviously decreased. *Note:* In this and in the succeeding illustrations the right hand film, marked with the letter A, is one made approximately three months after that on the left.

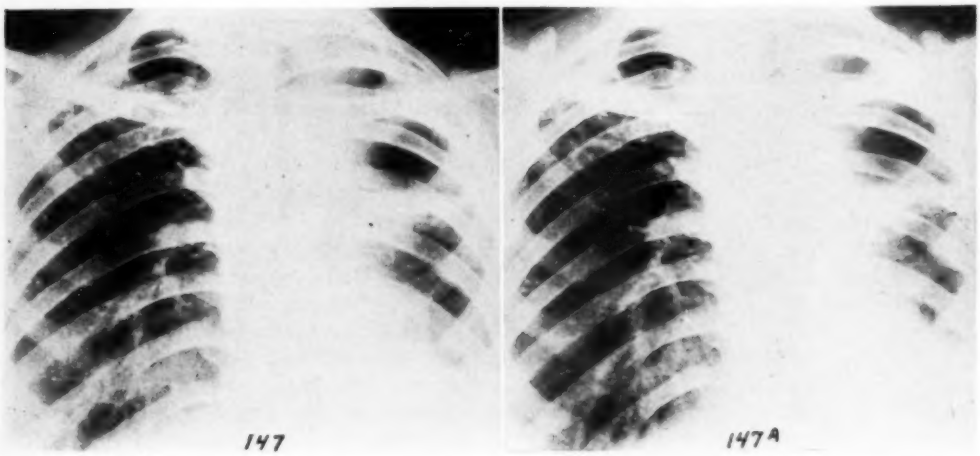

Fig. 3. Case 147. *Agreement.* All 12 readings recorded *no change.* The bilateral cavities and infiltration and the left pleural thickening are not significantly changed during the three months interval between the two films.

which were "easy" and those which were "difficult."

SUMMARY OF RESULTS

Much of the above information can be summarized in two tables, one showing variations between the different readers and the other variations in an individual reader. Tables VII and VIII are constructed to show what may be expected when a hypothetical set of 100 film pairs is interpreted by different readers (Table VII) or interpreted twice by the same reader (Table VIII). The material indicates how many of the 100 readings will be in *complete agreement,* how many in "*simple*

TABLE VII: SUMMARY TABLE PRESENTING AN ESTIMATE OF THE RESULTS OF READINGS BY TWO DIFFERENT READERS ON 100 FILM PAIRS; NUMBER OF READINGS WHICH WILL BE "AGREEMENTS," "SIMPLE DISAGREEMENTS," AND "COMPLETE REVERSALS"

(According to a number of factors discussed in the text)

Comparisons Relating to	Number per 100 Dual Readings			"Complete Reversals" Based on Comparisons Which Exclude Readings of "No Change"
	"Agreements"	"Simple Disagreements"	"Complete Reversals"	
Entire Lung Field	69.9	25.6	4.5	10.4
Right Lung	70.5	27.7	1.8	5.6
Left Lung	71.5	24.3	4.2	11.7
Quality of Films				
"Good Technic"	73.4	21.7	4.9	11.2
"Poor Technic"	63.0	33.4	3.6	8.6
Specialty of Reader				
Phthisiologists	72.9	21.7	5.4	10.5
Radiologists	70.8	26.2	3.0	8.1
Source of Material				
"Sanatorium, Public"	67.7	29.5	2.8	10.7
"Streptomycin"	67.3	25.6	7.1	12.1
"County Hospital"	74.1	20.8	5.1	10.0
"Sanatorium, Private"	78.9	18.7	2.4	4.7

TABLE VIII: SUMMARY TABLE PRESENTING AN ESTIMATE OF THE RESULTS OF TWO READINGS BY THE SAME READER ON 100 FILM PAIRS; THE NUMBER OF READINGS WHICH WILL BE "AGREEMENTS," "SIMPLE DISAGREEMENTS," AND "COMPLETE REVERSALS"

(According to a number of factors discussed in the text)

Comparisons Relating to	Number per 100 Dual Readings			"Complete Reversals" Based on Comparisons Which Exclude Readings of "No Change"
	"Agreements"	"Simple Disagreements"	"Complete Reversals"	
Entire Lung Field	78.5	18.4	3.1	6.7
Right Lung	79.2	19.6	1.2	3.4
Left Lung	79.1	18.1	2.8	7.0
Quality of Films				
"Good Technic"	79.5	17.0	3.5	7.5
"Poor Technic"	76.3	21.3	2.4	5.0
Specialty of Reader				
Phthisiologists	76.3	19.0	4.7	9.1
Radiologists	80.6	17.8	1.6	3.8
Source of Material				
"Sanatorium, Public"	75.2	22.6	2.2	7.5
"Streptomycin"	77.3	17.4	5.3	8.5
"County Hospital"	85.5	12.0	2.5	4.7
"Sanatorium, Private"	83.1	15.8	1.1	2.0

disagreement" (that is, when one reading is "no change" and the other either "better" or "worse"), and how many will be in *complete disagreement* (that is, one reading will be "better" and the other "worse"). Such comparisons are shown for many of the factors discussed above.

DISCUSSION

The main finding in this study is that in the evaluation of two single postero-anterior chest x-ray films taken three months apart, physicians of considerable experience in chest roentgenologic interpretation are likely to disagree with one another in nearly one-third of the cases, and a single interpreter is likely to disagree with himself in about one-fifth of the cases. Since important clinical decisions often rest on such interpretation, this revelation is of some moment. Further, it supplements and confirms previous studies on the "error" problem in the interpretation of single chest roentgenograms (3, 5, 7, 8). This does not mean that x-ray films are not useful. They are still the most dependable single piece of evidence in chronic pulmonary disease. However, they should not be taken as the sole criterion of the patient's progress, nor can decisions rest on them

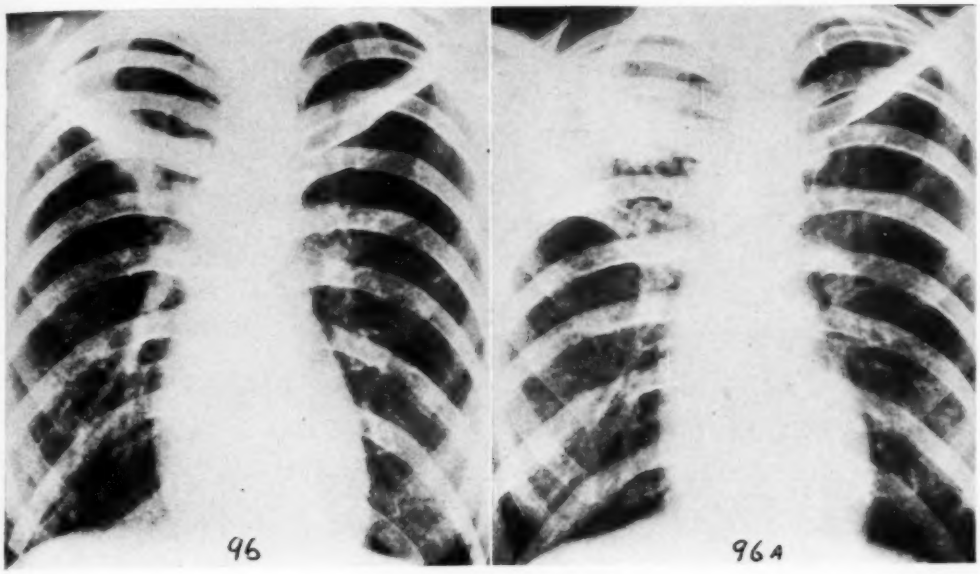

Fig. 4. Case 96. *Agreement.* All 12 readings recorded as *worse.* The right upper pulmonary lesions are more extensive.

alone. The dynamic status of pulmonary lesions cannot be determined without other clinical or laboratory studies in addition to the comparison of serial chest roentgenograms.

In addition to utilizing other clinical procedures, it should be remembered that serial x-ray examination of the chest should not be limited to single postero-anterior films. Stereoscopic postero-anterior, lateral, lordotic, oblique, and other views should be used along with fluoroscopic examination to provide adequate examination in appropriate cases. Although no specific information is available on the extent to which this extra care may add to the reliability of roentgenographic evaluation, clinical evidence warrants the assumption that these additional procedures are helpful in a significant proportion of cases when indicated.

It should also be emphasized that inconsistency in diagnosis is by no means limited to radiology. In fact, it is likely that roentgenography is one of the more reliable and exact of diagnostic procedures in medicine. It is only because radiology

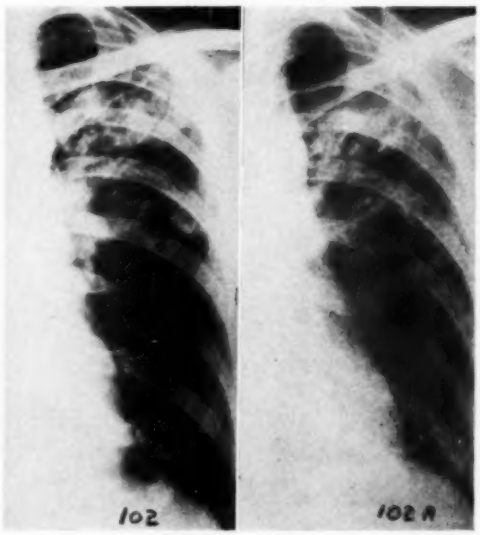

Fig. 5. Case 102. In this case, there was *disagreement:* 4 interpretations were worse, 2 no change, and 6 better, abbreviated as "4W, 2NC, and 6B." The readings "worse" were probably based on the fresh lesions at the 3rd space in 102A. The fact that these represent only a small fraction of the total volume of the disease present may account for the readings of "no change." The readings "better" may have been due to the apparent decrease in size of the cavity present at the level of the 1st space.

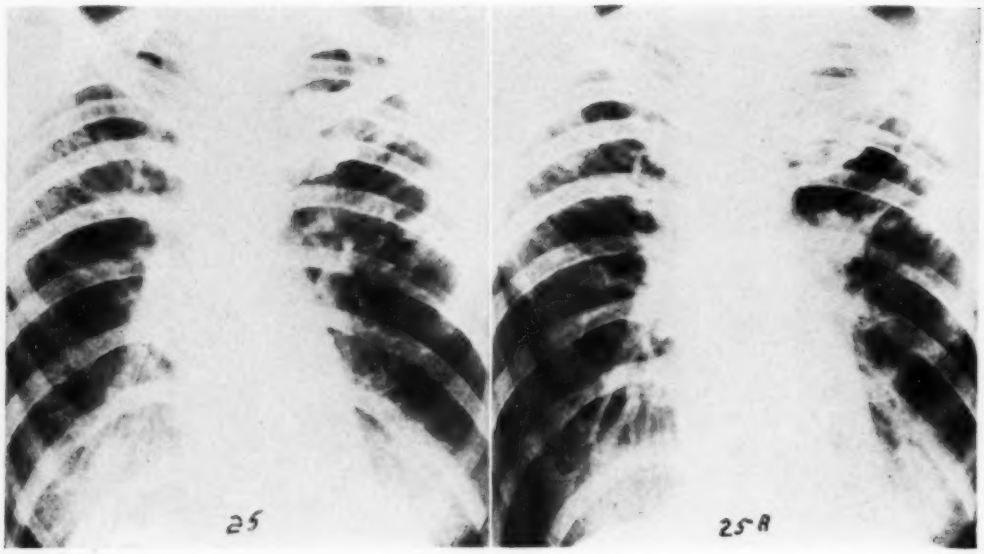

Fig. 6. Case 25. *Disagreement*: Readings: 4 worse, 3 no change, 5 better. In group conferences, held subsequent to the completion of the entire set of twelve readings, some of the readers stressed the improvement in the left lung cavity, which had definitely decreased in size. Others noted the new left parahilar density, and therefore interpreted the film as "worse." The remaining readers presumably decided that these changes more or less balanced each other, and therefore read the second film as "no change."

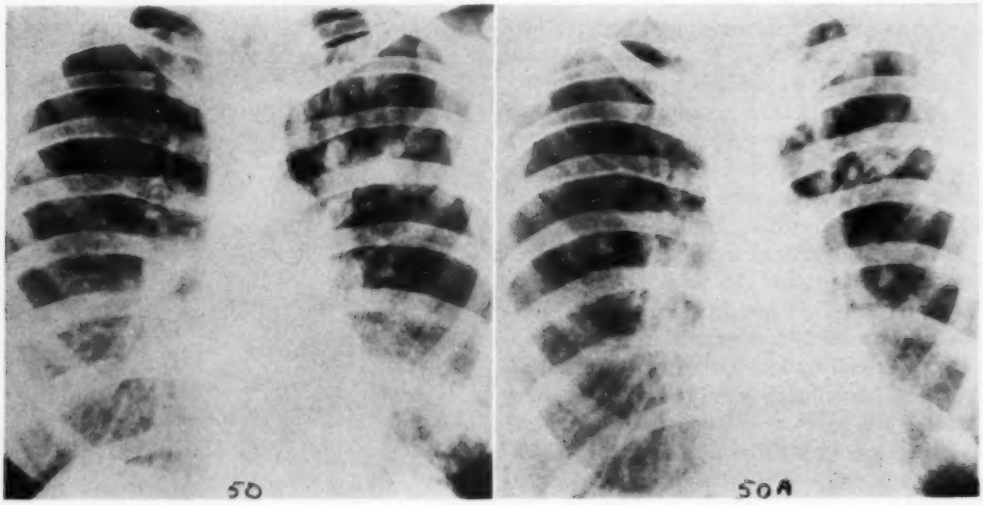

Fig. 7. Case 50. *Disagreement*: 5 readings worse, 7 better. One reader (who disagreed with himself) interpreted the second film as better on his first reading, with the comment "right apex and left first space clearing," but on the second reading read the second film as worse, with the (correct!) comment "new lesion in right second space." One reader thought that there were some nodular lesions visible in 50A which had been concealed by ribs in 50. This case exemplifies conflicting or paradoxical changes of the type which tend to result in different interpretations.

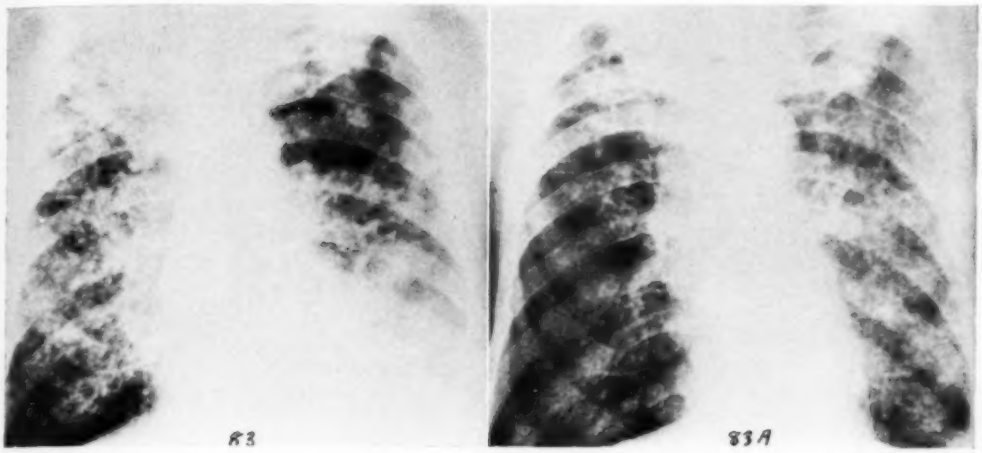

Fig. 8. Case 83. *Disagreement.* Interpretations: 5 worse, 2 no change, 5 better. A case with very extensive bilateral disease. In several such cases with multiplicity of lesions there appeared to be difficulty in evaluating change.

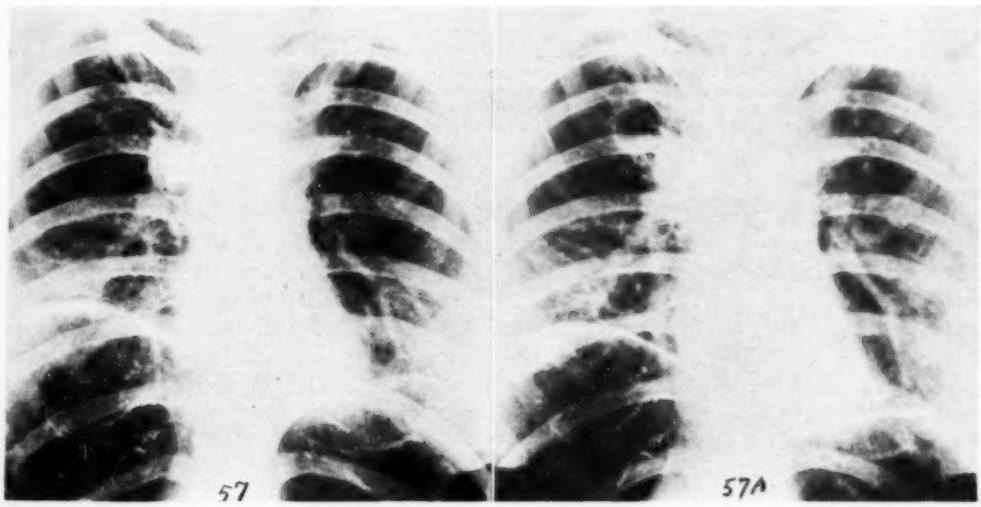

Fig. 9. Case 57. *Disagreement.* The interpretations were: 9 worse, 2 no change, 1 better. One reader noted "no change" at one interpretation and "worse" at another; in interpreting "no change" his comment was "cavity may be larger," and at the second reading the comment was "cavity larger." We have no explanation for the readings "no change" and "better."

lends itself more readily to quantitative evaluation of the degree of error that discrepancies in x-ray interpretation have been demonstrated in recent years. From such evidence as has appeared in the literature, it is apparent that the same problem is present in many other diagnostic fields (1, 2, 4). If similar objective investigations were conducted in such clinical fields, it is likely that the degree of error found would be similar to if not greater than that observed here.

As a corollary of the present study, it is desirable that work be continued on the factors which influence errors in film interpretation. These include the elements of personal training and ability, technic, terminology, etc. (6, 8). The demonstra-

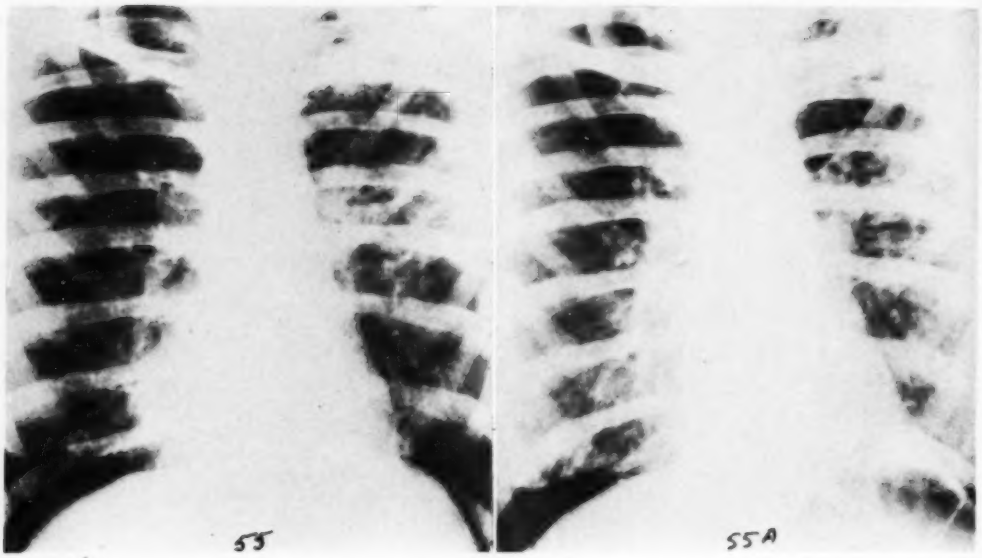

FIG. 10. Case 55. *Disagreement.* Interpretations: 8 worse, 4 better. The second film of this pair had three comments, one by a reader who interpreted it both times as better; the first time he made the comment: "If interpreted as annular cavity, would be worse." One reader interpreted the second film as worse, and made the comment "poor technic." Another reader also made the comment "poor technic" in one of his readings. Undoubtedly, part of the disagreement in this case resulted from the technical quality of the second film (less dense). However, even allowing for this, the case does illustrate marked divergence of interpretation among experienced readers under controlled conditions.

tion that technically unsatisfactory films are less reliably read reinforces the need for better and more consistent technical methods.

Terminology and description need much study. It is necessary to develop more dependable methods of classifying lesions shown on a single x-ray film and to determine more reliable standards for evaluating the dynamic status of disease as reflected in such films. In the attempts made in the preliminary trials of the present study to obtain greater uniformity, it became apparent that the problem of evaluating changes in serial films is closely allied to that of determining and classifying the (*a*) "character" or "quality" of a lesion and (*b*) its "extent." The solution to these problems must await further investigations of these phases.

SUMMARY

In this study an attempt is made to assess the reliability of estimates of change in serial postero-anterior roentgenograms of the chest. A set of 150 14×17-inch film pairs taken three months apart were interpreted independently twice by each of three radiologists and three phthisiologists of considerable experience in their respective fields. The following findings were obtained:

1. In judging a pair of films for evidence of progression, regression, or stability of disease, two readers are likely to disagree with each other in nearly one-third of the cases, and a single reader is likely to contradict himself in about one-fifth of the cases.

2. A significant but relatively small part of the error in interpretation results from variations in technical factors in the two films.

3. The major reason for disagreements in serial film interpretation is not due to film pairs in which contradictory evidence is produced by the two lungs; a reader disagrees with himself or with another

reader almost as much in evaluating changes in a unilateral as in a bilateral lesion.

4. When a reader judges the second film of a pair as being either "better" or "worse," the chances are that in about 10 per cent of the cases another reader will use the opposite classification; and the same reader is likely to reverse his own original diagnosis in about 7 per cent of the interpretations of the same pairs.

ACKNOWLEDGEMENTS: The authors wish to express their gratitude to Dr. Merrell Sisson, who did the major work of selecting the film pairs used in this study. They also wish to thank the assistants and staff of Professor Yerushalmy for the extensive statistical analysis. The entire work was aided in part by funds generously provided by the General Electric X-Ray Corporation, the Eastman Kodak Company, and the Picker X-Ray Corporation.

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SUMARIO

Estudios del Valor de las Radiografías Seriadas para Calcular la Evolución de las Afecciones Pulmonares

En este estudio trátase de justipreciar la exactitud de los cálculos de las variaciones en las radiografías postero-anteriores seriadas del tórax. Un grupo de 150 pares de radiografías de 35 × 42.5 cm. tomadas a plazos de tres meses fué interpretado separadamente por tres radiólogos y tres tisiólogos de mucha experiencia en sus respectivas especialidades. Los hallazgos fueron los siguientes:

1. Al juzgar un par de radiografías en busca de signos de avance, regresión o estabilización de la enfermedad, lo más probable es que dos lectores discuerden entre sí en casi la tercera parte de los casos y que un solo lector se contradiga a sí propio aproximadamente en la quinta parte de los casos.

2. Una porción significativa, pero relativamente pequeña, de los errores de interpretación proviene de las variaciones de los factores técnicos en las dos radiografías.

3. La principal causa de los desacuerdos en la interpretación de las películas seriadas no procede de pares de radiografiías en que los dos pulmones arrojan datos contradictorios; un lector discrepa de sí propio o de otro lector casi tanto al apreciar las alteraciones en una lesión unilateral como en una bilateral.

4. Cuando un lector emplea las expresiones de "mejor" o "peor" para un par de películas, las probabilidades son de que, aproximadamente en 10 por ciento de los casos, otro lector use la clasificación opuesta, y es probable que el mismo lector invierta su propio diagnóstico primitivo aproximadamente en 7 por ciento de las lecturas de los mismos pares de radiografías.

(*For Discussion see following page*)

DISCUSSION

Eugene P. Pendergrass, M.D. (Philadelphia, Penna.): The observations of Dr. Garland and his collaborators are in line with those made by Dr. Garland himself on a previous occasion and by Dr. Birkelo and his associates in 1947. The authors state that the main finding in their study is that in the evaluation of two single postero-anterior chest x-ray films, taken three months apart, physicians of considerable experience in chest roentgenologic interpretation are likely to disagree with each other in nearly one-third of the cases, and a single interpreter is likely to disagree with himself in about one-fifth of the cases. This, they say, "does not mean that x-ray films are not useful. They are still the most dependable single piece of evidence in chronic pulmonary disease. However, they should not be taken as the sole criterion of the patient's progress, nor can decisions rest on them alone. The dynamic status of pulmonary lesions cannot be determined without other clinical or laboratory studies in addition to the comparison of serial chest roentgenograms."

The authors further state that, "in addition to using other clinical procedures, it should be remembered that serial x-ray examination of the chest should not be limited to single postero-anterior films. Stereoscopic postero-anterior projections, lateral, lordotic, oblique, and other views should be used along with fluoroscopic observation to provide adequate examination in appropriate cases."

This study serves to re-emphasize that when examination of the chest is limited to conventional roentgenograms, many variations in interpretation will result, no matter how experienced the observer. Conventional roentgenograms are only a small part of a chest study. In tuberculosis and in many other conditions this should include more than the fluoroscopic observation, roentgenograms of varying density, and in different phases of respiration, and in different projections. Our studies have led me to believe that, if one wishes to follow the progress of a lesion by roentgenography, it can in many instances be done satisfactorily only by body-section roentgenography. Body-section roentgenography, of fine detail, is not utilized and exploited in this country as much as it is in Sweden and elsewhere. I have seen lesions in sick tuberculous patients which have been impossible to evaluate by conventional studies; yet with body-section roentgenography, one could follow the regression of the lesion with utmost ease. Some of these lesions, on the conventional stereoscopic roentgenograms, seem to measure 1 × 1 × 2 cm. The same lesions when studied on body-section roentgenograms are shown to be several centimeters larger in all dimensions.

It should be stated at this point that the great majority of body-section roentgenograms are of extremely poor technical detail, due largely to the type of apparatus employed.

There are many factors which contribute to the visibility or the perceptibility of shadows seen in a chest radiograph. These can be grouped into physical and psychophysiological factors. A number of articles have been written on the physical factors. One of the best of these is by Dr. Newell.[1] Very little, however, has been written on the psychophysiological factors. Time does not permit discussion of either of these groups, but I do want to emphasize two points in connection with the psychophysiological factors. These are factors involved in defective scanning and factors of apperception. The path of the eye must include the lesion and, assuming that the lesion is included in the path of the eye, the lesion must register. Until this is accomplished to a high degree, all of us will be susceptible to recording varying interpretations.

Robert R. Newell, M.D. (San Francisco, Calif.): I have two things I want to say. One is that I am deeply interested in what Dr. Garland is doing in trying to lay a scientific foundation under roentgen diagnosis. It is important that we should know what we can see and what is the dependability of our conclusion, and inasmuch as man is fallible it is important that we should have as good a measure as possible of the probability of success and the probability of error. So, if we are going to take action on our conclusion, it is necessary to know whether a pulmonary lesion is getting better or getting worse.

The other thing I would like to say is in reference to this question of names. I think that we ought to have a truly pragmatic attitude toward language and terms. I think that the test of the use of a term is whether it conveys your meaning to the man who is listening to you or reading your article. I admire those purists who like to use their terms in a perfectly beautiful etymologic fashion and according to the dictionary, but the real test is whether you get your meaning over.

I, too, think that "miliary tuberculosis" is a bad term because I find that there is not a single one of my medical students who has ever seen a millet seed. And what is the use of naming anything after a thing no one has ever seen? I would say you should have in your mind what your listener is going to believe when you use the term, and when you say "miliary tuberculosis" he is

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[1] NEWELL, R. R., AND GARNEAU, R.: The Threshold Visibility of Pulmonary Shadows. Radiology **56:** 409–415, March 1951.

going to think you mean acute, disseminating tuberculosis throughout the body, which is a pretty big diagnosis to make on a chest film.

Ross Golden, M.D. (New York, N. Y.): Many years ago I became impressed with the difficulty of comparing lung shadows on two different chest films, and became aware that I could do it better on stereoscopic films than on flat films. Then it became apparent that I could not make nearly as accurate a comparison by shifting one pair and then another into a stereoscopic apparatus as I could if two pairs were set up for stereoscopic vision side by side, so that the eye could go instantly from one pair to the other. We need the information presented to us by Dr. Garland. However, we also need badly, in my opinion, a stereoscopic apparatus in which we could set up at least two pairs of stereoscopic chest films in such a way that the observer's eye could go instantly from one pair to the other. Furthermore, if it becomes of critical importance to get an accurate comparison of shadows in pulmonary tuberculosis, I wonder whether tomography would not be of help.

Dr. Garland (*closing*): In reply to Dr. Pendergrass, it is my impression that serial body-section films might actually increase rather than decrease reader inconsistency, at least in group tests of the type discussed in our paper. However, it is true that in an occasional case they should permit more reliable interpretation of such changes as are present.

Dr. Golden's comments on the desirability of stereoscopes designed to permit simultaneous study of two sets of 14 × 17-inch films are fully concurred in. Whether such aids would increase consistency or reliability of interpretation remains to be shown. Many physicians have so much difficulty with single sets of stereoscopic films that I suspect they would resort to comparison of the individual roentgenograms.

Two important aspects of the problem are (*a*) the existence of a 10 per cent major disagreement between experienced physicians in estimating the progress of pulmonary disease on the same set of serial films, and (*b*) the fact that an "expert" is going to reverse completely his own previous diagnostic conclusion in 7 per cent of cases. One has to test oneself on a study of this kind to become fully aware of his own fallibility in this regard. It has been my own experience that, having tested oneself, one then approaches the problem of roentgen interpretation with greater and more critical interest, and with considerably more humility. Radiology lends itself to scientific tests of this kind with unique readiness.

Dual reading of single films in mass surveys has been shown to increase the number of "positives" detected by a factor of about 20 per cent. We are making further studies of our serial film material to ascertain whether comparable improvement can be obtained by dual reading.

Variations in the Roentgen Appearance of the Skeletal System in Myeloma

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New York, N. Y.

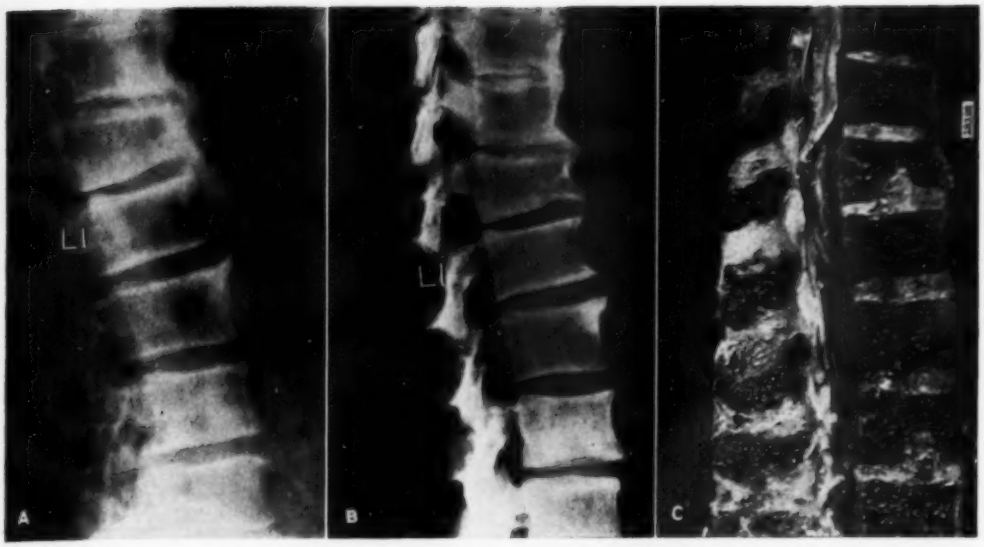
THERE IS AN increase in appreciation of the difficulties in establishing the diagnosis of myeloma by the appearance of the osseous structures. The concept of a "punched-out" area as the universal bone lesion has been generally discarded. Camp (8), discussing Kinney's paper (13) on multiple myeloma, stated: "I know of no characteristic roentgenographic picture which will permit an unquestioned diagnosis of multiple myeloma." Batts (5) found in a review of 40 cases that it was impossible in 16 of these (40 per cent) to make a definite diagnosis by means of roentgen examinations. Lichtenstein and Jaffe (15) studied 18 cases of myeloma and concluded that the classical feature of multiple discrete destructive lesions is the exception rather than the rule. Osteoporosis as a significant manifestation of the disease has been previously emphasized (6, 5, 2). Instances of myeloma without demonstrable bone lesions have been cited in the literature (6, 20, 1). Several authors (1, 2, 3, 5) have classified the bone changes based on roentgen impressions. The terminology, however, has been principally descriptive, with no attempt to correlate the roentgen findings with the anatomical alterations.

During the past ten years 66 cases of proved multiple myeloma were studied at Montefiore Hospital. Because of the long-term care program at this institution, it was possible to follow most of these cases for the duration of the illness. Twenty-seven of the group came to autopsy. Sixty-two of the patients had x-ray examinations, which ranged from limited views of the skeletal system made at one sitting to numerous studies done over a period of many years. On a review of the roentgenograms of all of these patients, it was found that the x-ray appearances of the bones could be placed in six groups. Correlation with the gross and histologic specimens was made to establish the pathological basis for the roentgen appearance.

CLASSIFICATION

1. *Normal:* The absence of any radiographically demonstrable abnormalities in an osseous structure could mean that the bone is uninvolved, that there is myelomatous infiltration of the marrow without alteration of the trabeculae, or that trabecular destruction is present but not macroscopic. Wagoner, Hunt and Pendergrass (19) made studies of excised vertebrae with artificial defects. They found that spongiosa defects are more readily detectable than cortical; lesions measuring $3 \times 4 \times 5$ mm. and $4 \times 5 \times 9$ mm. were demonstrable, but it was considered highly questionable that these would have been detected had not their presence already been known. A cortical dehiscence as large as 10×10 mm. was missed. Ardran (4), also employing resected vertebrae, demonstrated that an area of bone destruction over 1 cm. in diameter may occur in the center of a vertebral body without being detectable on the x-ray film. Shackman and Harrison (17) showed a definite discrepancy between the x-ray and gross anatomical appearance of osseous structures with tumor metastases. In 2 of 4 cases in which they made contact radiographs of excised bones with naked eye tumor metastases, no radiographic changes were apparent.

[1] From the Department of Diagnostic Roentgenology, Montefiore Hospital, New York, N. Y. Accepted for publication in July 1951.



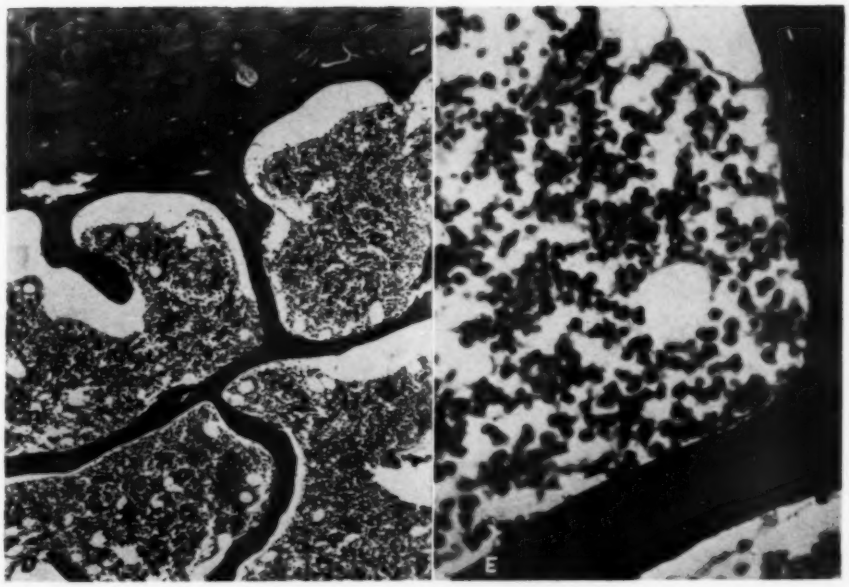


Fig. 1. Roentgenologic and pathologic studies of the lumbar spine of a 67-year-old female who died of myeloma without exhibiting any significant osseous abnormalities.

A. Lateral roentgenogram. Mineralization except for L-2 normal for this age group. Radiolucency in L-2 represents gas within bowel.

B. Roentgenogram of excised specimen. Absence of overlying soft tissues yields sharper details. Trabecular thinning apparent in L-2.

C. Photograph of hemisection of thoracolumbar spine. The bone is grossly normal in appearance except for some areas of focal trabecular destruction in L-3 (3rd from the bottom). Several Schmorl's nodes are incidentally demonstrated.

D. Photomicrograph of a grossly normal appearing vertebra showing normal trabecular pattern. × *c.*40.

E. Photomicrograph taken from same field as D, showing diffuse myelomatous infiltration of the bone marrow. × *c.*125.

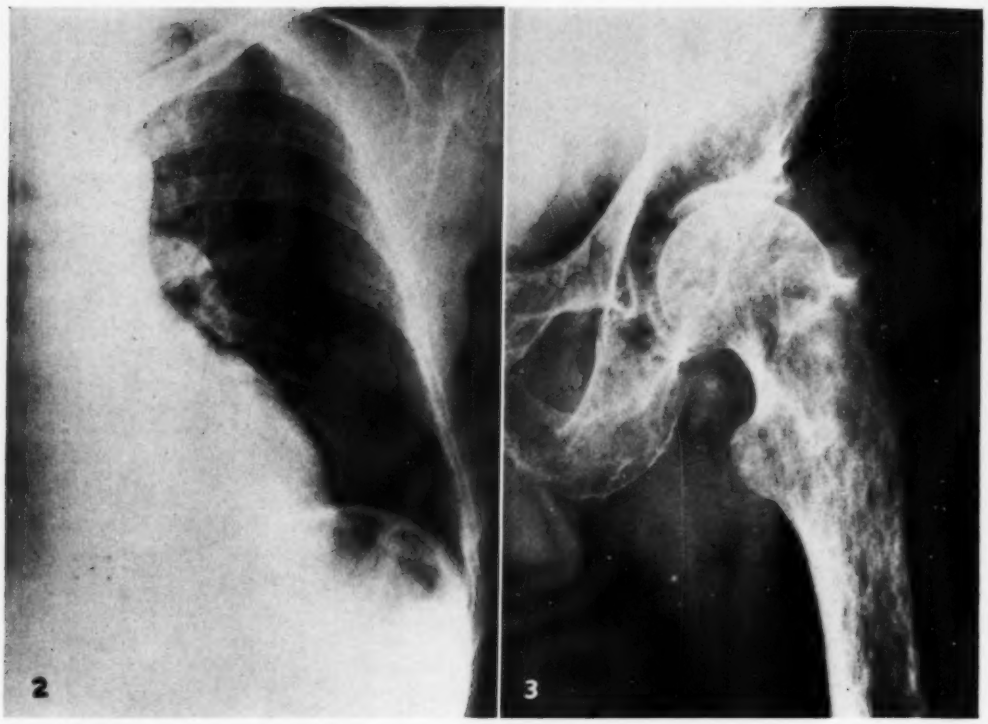


Fig. 2. Roentgenogram of left thorax revealing osteoporosis of the ribs with no evidence of focal destruction. Histologic examination disclosed diffuse involvement of the rib marrow by myeloma.

Fig. 3. Roentgenogram of the proximal left femur illustrating reticulated pattern seen in the indeterminate group. The appearance simulates severer degrees of osteoporosis, but osteolysis cannot be excluded.

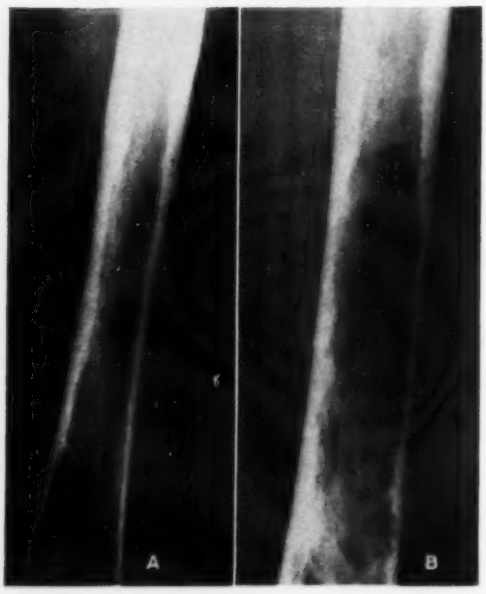
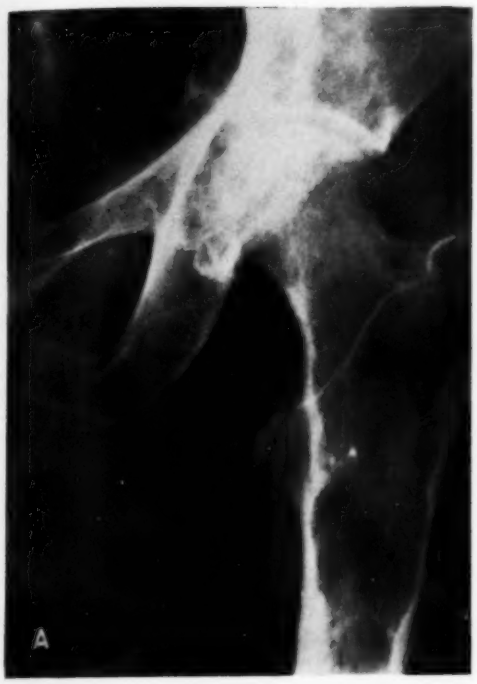


Figure 1 illustrates extensive myeloma involvement in a lumbar spine which roentgenographically was not remarkable.

2. *Osteoporosis:* Thinning of the trabeculae and osseous demineralization with increased radiolucency are not pathognomonic of myeloma. Identical findings may be seen with senile or postmenopausal osteoporosis, hyperthyroidism, hyperparathyroidism, or disuse atrophy. When osteoporosis is present in the vertebral column, the disks tend to expand in proportion to the degree of halisteresis. Figure 2 demonstrates demineralization as the only roentgen manifestation of a histologically proved myeloma.

Fig. 4. Example of the time factor in evaluating an indeterminate roentgen appearance. A. Mid shaft of left femur showing a spotty osteoporotic pattern. B. Same segment of left femur taken eight months later. There are definite destruction of the medulla and erosion of the cortex.



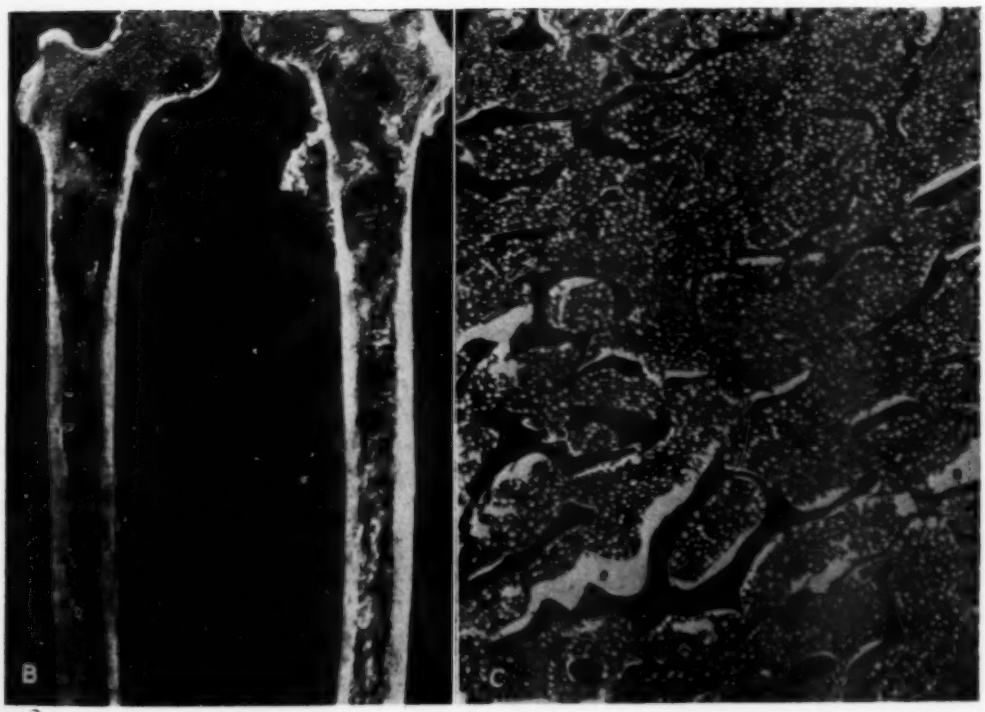
3. *Indeterminate Group (Osteoporosis vs. Osteolysis)*: This group appears to be transitional between the preceding osteoporotic class and those cases presenting definite destruction of a poorly defined type. Radiographically (Figs. 3, 4A, 5A) the picture is one of spotty osteoporosis in

Fig. 5. Roentgenogram and anatomical specimens of a left femur.

A. Roentgenogram revealing trabecular thinning in the head and neck with suggestive areas of destruction at the periphery of the head near the junction with the neck. Definite coalescent destructive lesions are present in the trochanteric and proximal shaft portions.

B. Photograph of hemisected specimen of the left femur. Though destruction in the mesial portion of the head is equivocal in the roentgenogram (A), it is definitely confirmed by this gross specimen. The trochanteric and shaft portions show complete replacement of the medulla by myeloma tissue. Endosteal erosion is seen particularly in the upper third of the specimen.

C. Photomicrograph of section taken from the head of the femur. On higher power there is demonstrated a moderately cellular marrow containing groups of myeloma cells. The lower left portion of the section shows normal trabecular pattern while the right upper section reveals trabecular thinning. × *c*.25.



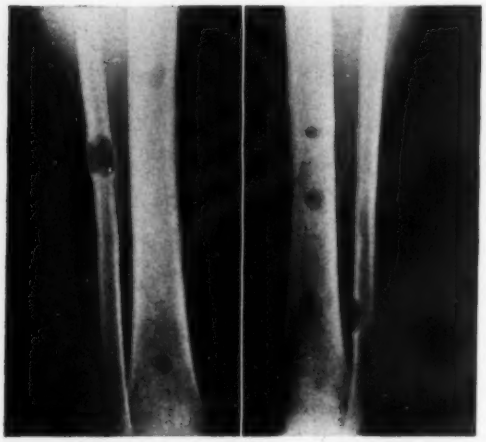


Fig. 6. The so-called classical appearance of myeloma of bone. The lesions are circular and sharply marginated and may encroach on and erode the cortex. The adjacent bone appears normal.

which diffuse demineralization is overlaid by focal, poorly demarcated radiolucencies. On pathologic examination, one sees trabecular thinning of varying degrees, irregularly interspersed with foci of trabecular dissolution (Fig. 5C). White and Tillinghast (21) described the pattern created particularly in the long bones and pelvis as crisscross or lattice-like.

This appearance, which may be encountered in skeletal surveys, raises the pertinent problem of differentiation between a destructive neoplastic lesion and severe demineralization as seen in metabolic bone diseases or as a result of immobilization. The question may be resolved by means of serial examination: the malignant lesion will progress to recognizable bone destruction, while a benign osteoporosis remains more or less stable or disappears with treatment (Fig. 4).

4. *Sharply Circumscribed Destruction:* This is the so-called "classical" type. The lesion appears "punched-out" (Fig. 6). It is generally circular and may present a border of increased density (Fig. 7). This type of involvement is rarely found in the spine (Fig. 8). The trabeculae within the area of destruction are completely effaced. The surrounding bone in the earlier phases of involvement appears entirely normal. The site of origin is usually the medulla. With progression, there is encroachment with occasional expansion of the cortex, followed successively by invasion of the periosteum and adjacent soft tissues. In the end stage

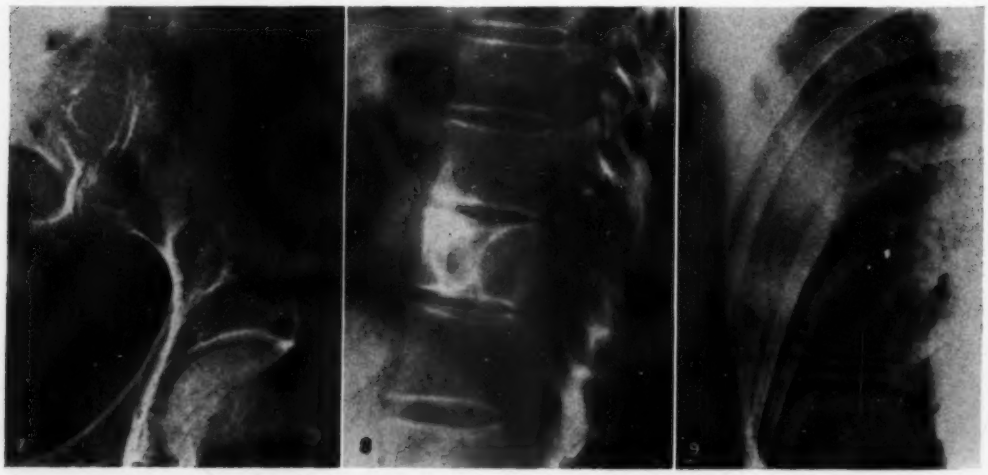


Fig. 7. A definite border of increased density may surround the lesion, as seen in this instance in the ilium.
Fig. 8. A well marginated lesion in the body of D-12 presenting a multiloculated appearance. This is probably produced by superimposition of sharply defined destructive lesions with borders of increased density, as seen also in Fig. 7. This was the only instance of this type of involvement seen in the spine.
Fig. 9. Destruction of posterior segment of the right 6th rib, with a large soft-tissue mass.

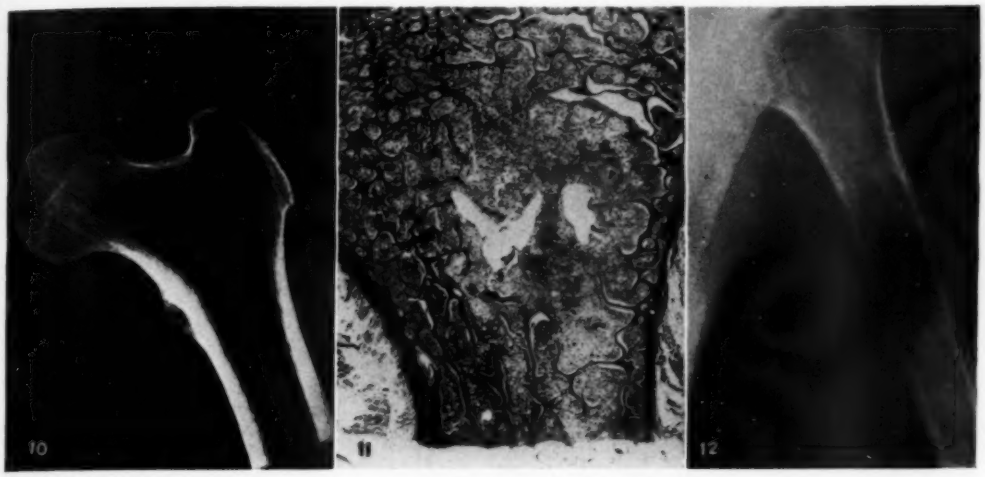


Fig. 10. Roentgenogram of a section of an anatomical specimen of the femur showing a local area of bone dissolution with adjacent medullary architecture normal. Microscopically this area showed sheets of myeloma cells and amyloid deposits.

Fig. 11. Section of ilium showing small focus of trabecular dissolution. In the marrow of this grossly "punched-out area," groups of myeloma cells were found. The lesion was too small to be visible on the roentgenogram. × *c.5.*

Fig. 12. Destructive lesion of proximal shaft of humerus. The margins of the lesion are poorly defined. The mesial aspect of the cortex is irregularly destroyed. There is no soft-tissue mass.

there is complete replacement of bone by the neoplasm, with the frequent formation of a soft-tissue mass (Fig. 9). Figures 10 and 11 illustrate the gross anatomical and the histologic appearance of lesions in this category.

5. *Poorly Circumscribed Bone Destruction:* The areas of osteolysis are not

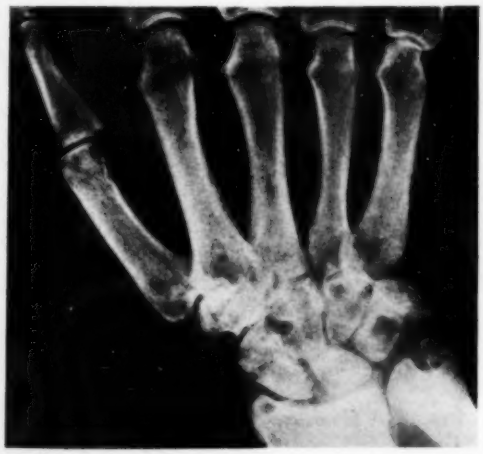


Fig. 13. Myeloma involving the carpus. This unusual location requires differentiation from rheumatoid arthritis, gout, and metastatic tumor.

Fig. 14. Destruction and collapse of a solitary vertebra. At this stage, with the adjacent vertebrae normal, differentiation from other destructive lesions is impossible.

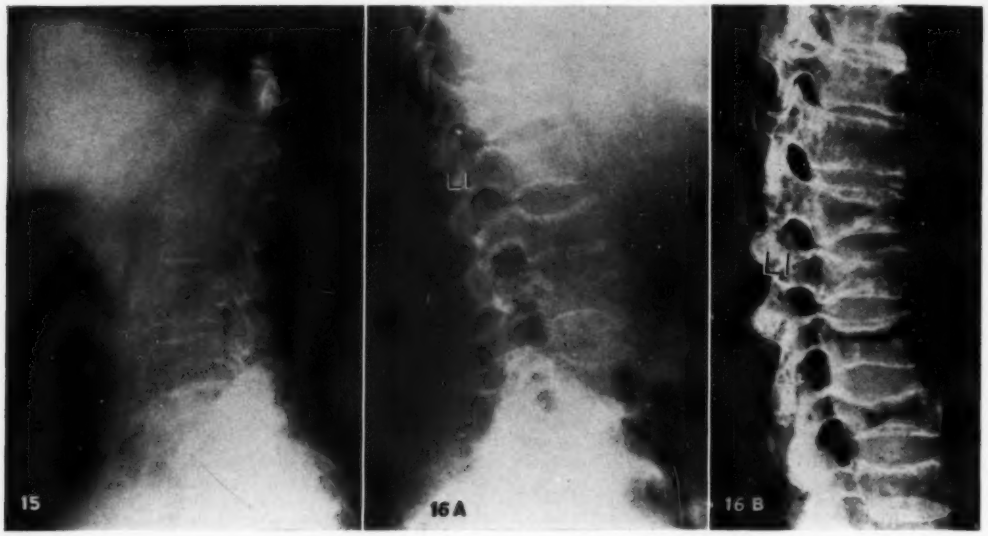


Fig. 15. Severe osteoporosis of the spine without collapse. This should be contrasted with Fig. 16. The body of L-1 is no longer identifiable. Even the cortical shell has been obliterated.

Fig. 16A. Roentgenogram of lumbar spine revealing principally demineralization with partial collapse of the vertebral bodies and ballooning of the intervertebral disks.

B. Roentgenogram of excised specimen (same case as A). Note extent of destruction not appreciated on the clinical roentgenogram. A very short time elapsed between these two studies.

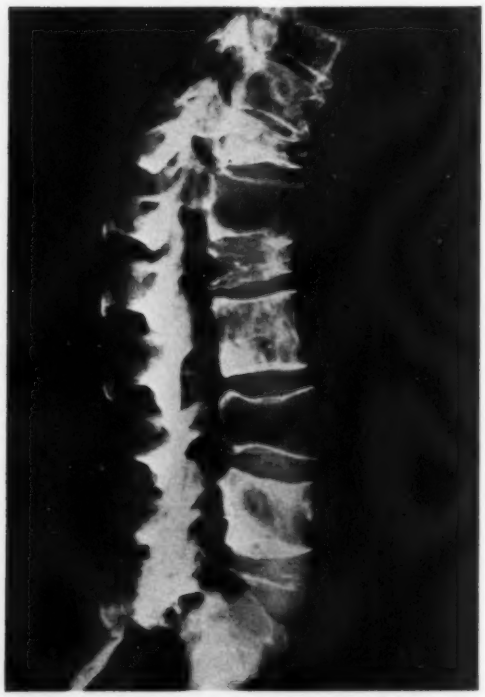


Fig. 17A →

sharply marginated and there is a subtle merging of the lesion with normal or osteoporotic bone. The appearance is similar to that of destructive bone metastases from the thyroid, breast, lung, kidney, etc. (Fig. 12). In the distal portion of the extremities the lesions may sometimes simulate rheumatoid arthritis or gout (Fig. 13). Destruction of a solitary vertebra may occur, while the remainder of the spine is normal (Fig. 14). This may be the initial manifestation of a solitary myeloma. Differentiation from metastatic tumor or tuberculosis of the spine in the early stage is difficult without biopsy.

6. *Severe Bone Destruction:* Severe bone destruction may be of three types. The most common is complete replacement of bone by tumor so that only a cortical shell of the structure remains (Fig. 5B). Obliteration of the medullary

Fig. 17A. Roentgenogram of excised lumbar spine illustrating different types of myeloma involvement in the same osseous structures. Complete loss of the internal architecture is seen in D-12 and L-3. Roentgenography was impossible *in vivo* because of the patient's poor condition.

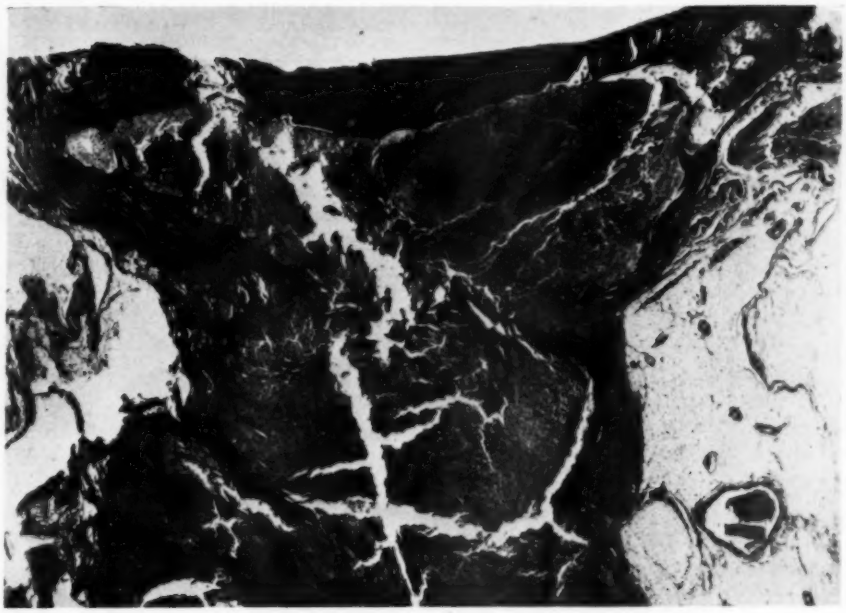


Fig. 17B. Photomicrograph of histologic section of L-3 disclosing partial collapse of the vertebral body and total trabecular destruction by tumor. ×8.

portion of the bone produces on the roentgenogram a homogeneously radiant area (Fig. 15). The cortex may appear paper-thin or disappear completely. The extent of the bone destruction may not be apparent because of overlying soft tissues. Figure 16 provides a comparison between the clinical roentgenogram showing demineralization and partial collapse with the x-ray study of the anatomical specimen, which discloses the true state of destruction. Variation in the patterns of severe osteolysis in contiguous vertebrae is illustrated in Figure 17.

The second type of this group is characterized by radiolucent areas marginated by surviving trabeculae, presenting a bizarre reticulated pattern (Fig. 18). In a small number of instances (third type) the involved areas are crisscrossed by large condensed trabeculae, resulting in a soap-bubble appearance such as may be seen in giant-cell tumor (Fig. 19).

The destructive changes in this category may simulate hyperparathyroidism, as indicated in a case report by Gill (11). The patient on roentgenographic ex-

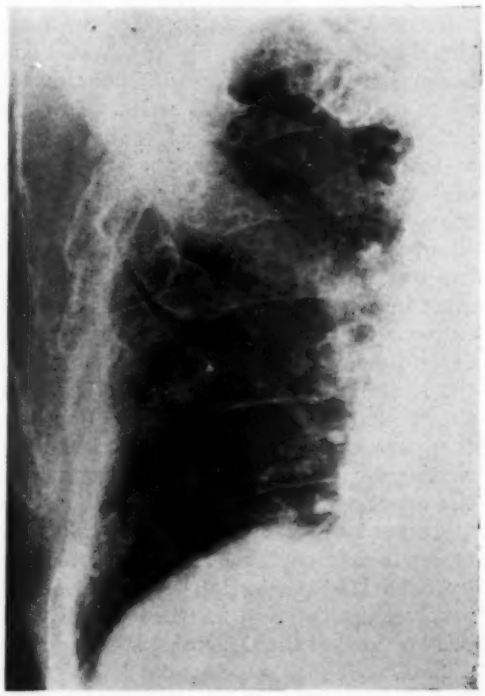


Fig. 18. Right ribs, showing a honeycombed pattern of severe destruction.

TABLE I: TYPE OF BONE INVOLVEMENT

Part	Number of Cases Examined	Roentgen Appearance of the Bones						Fractures	Soft-Tissue Mass
		Normal	Osteoporosis	Indeterminate	Well Circumscribed Destruction	Poorly Circumscribed Destruction	Severe Destruction		
Skull	53	12	2	2	32	5	0		
Spine	51	9	16	1	1	4	20	37	3
Pelvis	51	12	4	12	12	5	6		3
Ribs	57	13	10	19	10	3	2	27	10
Long Bones	*		9	33	39	9	9	13†	

* All bones were classified individually because the appearance of each bone varied occasionally even in the same patient. The normal group was omitted since it was rare that asymptomatic areas were subject to x-ray surveys.

† Total number of cases with fracture of long bones. Many showed multiple fractures.

amination showed extensive areas of bone destruction involving practically the entire skeleton. Laboratory studies revealed a hypercalcemia and a normal A/G ratio. On the basis of a rather firm radiologic opinion favoring hyperparathyroidism, a partial parathyroid resection was done without improvement. On autopsy myeloma was found.

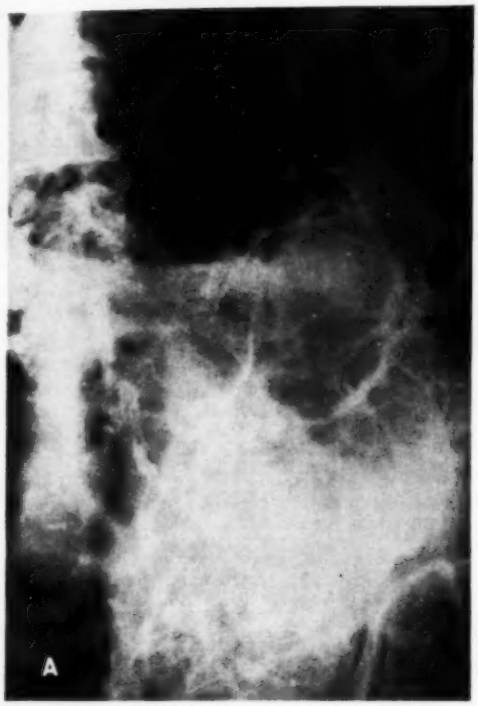
ROENTGEN FINDINGS

Table I indicates statistically the relative frequency of the six types of bone findings, based on the roentgenograms of all of the patients in this series. In each instance the group to which a change was assigned represents the more severe degree of tumor replacement. For example, a spine which was demineralized but also showed destruction of one or more vertebra was placed in the last category. It must be stressed that the time factor is of extreme importance. In the early stage, despite complaints of pain or neuralgia, the bone may show no abnormalities. At the other extreme, extensive bone devastation was observed quite by accident on routine x-ray examination. In general, as the disease progressed the skeletal system underwent a gradual transition from normalcy to extreme bone loss. As indicated by Table I, a predilection for a type of bone involvement could be ascribed to the various portions of the skeletal system.

Skull: The "punched-out" lesion is found most often in the calvarium. This might be explained by the thinness of the bone and the relatively small amount of overlying soft tissue. Therefore, smaller isolated lesions should be more readily detectable. In addition, there is no problem of superimposition of lesions, as may occur in the long bones or the vertebrae. The involved area usually appears sharply circumscribed and varies in diameter from 2 or 3 mm. to 1 cm. or more. All portions of the skull are affected, though the base is rarely examined. Frequently it is difficult to differentiate myeloma defects about the parasagittal areas from pacchionian body dehiscences or diploic venous lakes. As the individual lesion expands and the number of foci increases, coalescence takes place. This results in a mottled appearance difficult to distinguish from osteolytic carcinoma metastases, especially at the initial film examination. Many of the skulls (12 cases) in the present series showed no abnormalities, while the remainder of the skeleton displayed severe ravages of the disease. Soft-tissue masses are not usually encountered and no fractures in the usual sense are seen.

Spine: The predominant appearance in the vertebral column is osteoporosis, which varies in extent from thinning of the trabeculae to complete effacement of the medullary architecture with only a faint outline of the cortex remaining. A well mineralized spine and the presence of destructive bone lesions elsewhere should militate against the diagnosis of myeloma. The vertebrae most affected are the lower dorsal and the lumbar. The frequency of

vertebral collapse is noteworthy and in this series was seen in 37 of the 51 cases (73 per cent) in which the spine was examined. Vertebral breakdown tends to be multiple, but rarely are contiguous verte-



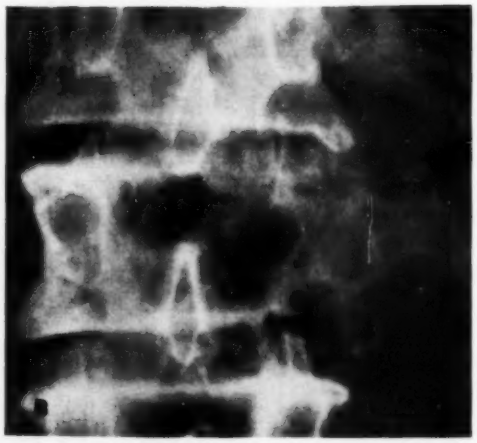


Fig. 19A. Myelomatous involvement of the ilium; large destructive lesion compartmented by coarse septae simulating giant-cell tumor.
B. Similar type of appearance in the body of L-1.

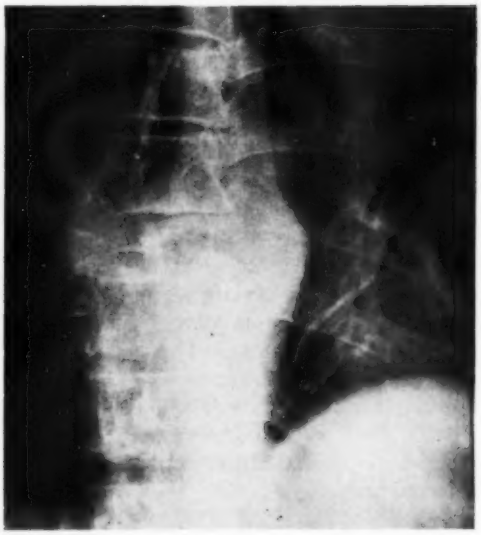


Fig. 20. Myeloma involving principally D-9, with extension across the intervertebral disk to D-8. A soft-tissue mass is present.

brae involved. In 3 separate instances soft-tissue mass formation (Fig. 20) was seen in association with the bone lesion. This is unusual for cancer metastases but may be seen with tuberculosis and occasionally with lymphoma. Even rarer was extension across and around the intervertebral disks as exhibited in 2 cases (Fig. 20). Though this is an exceptional finding, it should always arouse a suspicion of myeloma.

Pelvis: In the pelvis every type of bone alteration occurs, with no special predominance as seen elsewhere. Pathologic fractures were not encountered and soft-tissue masses were infrequent.

Ribs: The usual appearance of the ribs in this disease did not allow for a definitive diagnosis of myeloma. In the absence of other evidence, it would be difficult to choose between a severe loss of calcium and a non-specific metastatic osteolysis. Many cases showed osteoporosis and an equal number of discrete circumscribed destructive areas. Fractures are very common, occurring usually in the lateral portions of the ribs. The ninth rib was the most frequent site of pathologic fracture.

The fourth through the tenth were about equally affected. In 10 cases soft-tissue masses were observed, usually near the axillary line.

Other Bones: Of the remainder of the skeletal system the femur was most frequently involved (35 cases). This might be explained by inclusion of the proximal portion of the femora in the oft examined pelvis. Similarly, because the scapula is partially included in studies of the chest, a high incidence of involvement is found in this bone (21 cases). This, however, is of no special aid in diagnosis, since, when the scapula is found to be involved, the ribs usually show similar changes. The other bones were affected in the following order of frequency:

Humerus	18 cases
Clavicle	9 cases
Radius	6 cases
Fibula	3 cases
Ulna	3 cases
Mandible	2 cases
Tibia	1 case
Carpus	1 case

The type of involvement most frequently seen in this group is discrete osteolysis, followed in frequency by osteoporosis, borderline destruction, and extensive destruction. Thirteen patients had fractures of the long bones. Many had multiple fractures, bringing the total to 19. The most commonly fractured bones were the femora and humeri.

LABORATORY STUDIES

An attempt was made to correlate the age, sex, chemical changes, and electrophoretic patterns with the varying degrees of bone alteration. The patients were classified into four groups on the basis of the extent of calcium loss as evaluated by the appearance of the skeletal system in the roentgenograms (Table II).

It was found that age had no relation to the type of bone involvement. Severe osseous destruction of the bone was found more often in males than in females, despite the higher incidence of osteoporosis in women in the postmenopausal period, representing the age group in which myeloma is more likely to be found. Incidentally the ratio of females to males (46 to 54 per cent) indicates a higher incidence in the former than is generally cited. The A/G ratio was reversed in 29 of a total of 46 cases (63 per cent) in which the study was done. Bence-Jones protein was found in 16 of 41 cases (40 per cent). The presence of these abnormal urinary proteins could not be correlated with the extent of bone involvement. Hypercalcemia (blood level above 11.0 mg.) was encountered in 17 of 36 cases (47 per cent). As would be anticipated, hypercalcemia coincided with the extent of the bone loss.

Electrophoretic studies performed on the sera were found to be of diagnostic value in 77 per cent of 22 of the more recent cases. In a series of more than 100 myeloma cases, Stern (18) observed diagnostically significant electrophoresis diagrams in 80 per cent. About 50 per cent presented a gamma type pattern and 30 per cent a beta type. The remainder were either normal or exhibited minor anomalies.

Bone marrow aspiration, either iliac or sternal, yielded positive cytological results in 92 per cent of the cases and thus constituted the most valuable test in establishing the diagnosis.

Metabolic studies were performed on several of the patients in this series by Laszlo, Schilling and Bellin (14). The data indicate that in multiple myeloma the mineral balance may be temporarily normal even where the osseous structures show severe destruction. In most instances, however, there is metabolic evidence of rapid bone breakdown leading to hypercalcemia. The negative mineral balance seen in these patients is similar to that accompanying other secondary bone neoplasms and is not felt to be diagnostic for myeloma. It is believed that the hypercalcemia in multiple myeloma is not related to the abnormal serum protein but is the result of rapid and excessive bone destruction. In this series the rate of osteolysis as gauged by metabolic studies is felt to have prognostic significance in

TABLE II: LABORATORY STUDIES

Degree of Bone Loss	Sex		A/G Ratio		Bence-Jones Protein		Blood Calcium		Electrophoresis Diagram*		
	Male	Female	Normal	Reversed	Absent	Present	Normal	Elevated (Over 11.0 mg.)	Gamma-type Pattern	Beta-type Pattern	Non-specific Pattern
None	3	5	3	4	2	4	2	0	1	1	1
Mild	5	1	3	2	2	2	2	3	4	2	1
Moderate	11	12	3	13	14	3	10	4	5	1	2
Severe	12	9	8	10	7	7	5	10	2	0	1
Totals	31	27	17	29	25	16	19	17	12	4	5
Percentage	54	46	37	63	60	40	53	47	57	20	23

* One patient had the very rare alpha type pattern. Roentgenologically there was moderate bone loss.

that the patients who exhibited a markedly negative calcium balance had a shorter duration of life than those whose calcium balances were normal.

DISCUSSION

The review of the roentgen examination of 62 cases of proved myeloma revealed a wide range in the appearance of the skeletal system from normalcy to extreme bone destruction. To a great extent the findings depended on the duration of the disease. In an occasional case x-ray studies may never yield a clue to the diagnosis. Eight cases (13 per cent) were encountered in which no bone alteration was demonstrable. Two of these came to autopsy and only the histologic examination established the diagnosis. A uniform type of bone involvement was rarely found. Typical combinations were: discrete punched-out lesions in the skull with osteoporosis of the ribs and severe osteoporosis and partial collapse of the vertebrae, or a normal skull with borderline destruction in the ribs, circumscribed destructive lesions in the pelvic bones, and osteoporosis of the spine. In only 8 cases (13 per cent) did skeletal surveys disclose so-called "punched-out" lesions in all of the bones involved.

Because of the common complaint in this disease of back pain, the spine is very often studied. In only one instance (Fig. 8) was a local destructive lesion encountered. Instead, demineralization of varying degrees, non-specific destruction, and collapse were the common findings. It is difficult to differentiate these lesions from those due to other benign or malignant causes. The presence of a paravertebral soft-tissue mass or extension of the area of destruction across the intervertebral disk should arouse suspicion of myeloma. The skull was most often the site of the well defined lesion; however, symptomatology is rarely ascribed to the calvarium so that the part is not too often examined to afford a clue to the disease.

Pathologic fractures were seen in 43 of the 62 cases (70 per cent). A lower incidence is reported by others. Batts (5) gives a figure of 23 per cent in a review of 40 cases. Geschickter and Copeland (10) found pathologic fractures in 62 per cent of myeloma cases in contrast to 33 per cent in metastatic carcinomas and 8 per cent in osteogenic sarcoma. In the present series many of the fractures were multiple, with the spine (37 cases) and ribs (27 cases) most frequently involved.

Contrary to the experiences reported elsewhere (9, 16, 12, 7), no instance of persisting solitary myeloma was encountered. One patient presented a solitary destructive lesion of D-9 with collapse of the vertebra. The diagnosis was not established until six months later, when a transverse myelopathy developed, requiring laminectomy and exploration. Two years later the disease process became generalized.

CONCLUSIONS

Sixty-six cases of multiple myeloma, in 62 of which x-ray studies were made, are

reviewed. Eight cases (13 per cent) showed no significant osseous changes. In the remainder a wide range of bone alteration was encountered, the type generally depending on the duration of illness. The changes were divided into five categories on the basis of degree of bone loss, destruction, and circumscription of the osteolysis as demonstrated roentgenographically. A correlation was made between the roentgenologic and the pathologic findings.

The so-called "typical" punched-out lesion was exceptional; it was found most often in the skull and seen as the exclusive type of bone lesion in only 13 per cent of cases. The high incidence of pathological fractures, soft-tissue masses and, in the vertebrae, extension of the destruction across a disk, is stressed. Because the roentgenogram may be unreliable in establishing the diagnosis of myeloma, laboratory studies, particularly bone marrow aspiration (92 per cent positive) and electrophoresis (82 per cent positive) should be done whenever this disease is suspected.

ACKNOWLEDGMENT: We wish to express our gratitude to Doctor Austin Johnston for assistance with the pathological material, and to Mr. Antol Herskovitz for the photography.

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SUMARIO

Variaciones del Aspecto Roentgenológico del Sistema Oseo en el Mieloma

Repásanse 62 casos de mieloma múltiple, en 58 de los cuales hiciéronse estudios radiográficos. Ocho casos (13 por ciento) no revelaron mayores alteraciones óseas. En el resto, observóse una amplia variación de alteraciones de los huesos, dependiendo por lo general la forma de las mismas, de la duración de la enfermedad. Esas alteraciones fueron clasificadas en cinco categorías conforme a la magnitud de la pérdida ósea, la destrucción y la circunscripción de la osteólisis según la mostraba la radiografía. Los hallazgos roentgenológicos y anatomopatológicos fueron correlacionados.

La llamada "típica" lesión excavada fué

excepcional, radicando más a menudo en el cráneo y constituyendo la forma exclusiva de lesión ósea sólo en 13 por ciento de los casos. Recálcase la elevada incidencia de fracturas patológicas, tumefacciones de tejido blando y, en las vértebras, extensión de la osteólisis a través de un disco. Por resultar la radiografía poco fehaciente para establecer el diagnóstico de mieloma, siempre que se sospeche la enfermedad, deben ejecutarse estudios de laboratorio, y en particular aspiración de la médula ósea (positiva en 92 por ciento) y electroforesis (positiva en 82 por ciento).

Radiation Therapy of the Non-Traumatic Painful Shoulder[1]

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NUMEROUS publications on radiation therapy of so-called "peritendinitis of the shoulder," "subacromial bursitis," "subdeltoid bursitis," or "supraspinatus tendinitis" have appeared since the original report of Codman in 1904 on subdeltoid bursitis. Some of the more recent reports, notably those of McCurrach (5), Pohle (7), Steen (9), Weinberg (10), Young, B. R. (11) and Young, H. H. (12) have stressed the response to radiation.

The purpose of this publication is to present the technic of treatment employed in such conditions and the results achieved in the Department of Radiology of St. Luke's Hospital (Chicago) during the past five years (January 1946–December 1950). A total of 433 patients were treated. For 318 of these the records are complete, and it is upon this group that the present paper is based. For simplification only, the term "bursitis" is used throughout. For purposes of classification and follow-up study, the cases are placed in three categories:

Group I, Acute: Duration of symptoms of pain, tenderness, and limitation of motion limited to seven days or less.

Group II, Chronic: Duration of symptoms over seven days. (One patient had a fourteen-year history.)

Group III, Acute Exacerbation of Chronic Bursitis: This category is actually a subdivision of Group II and represents those patients who had an acute flare-up of tenderness and pain with marked limitation of motion. These patients have had previous similar attacks over periods of months or years.

By classifying cases in this manner we have eliminated the "subacute" type, primarily because we feel that this is too vague and too subjective an observation and permits little uniformity in comparing or evaluating results.

The primary symptom in all patients was, of course, pain of some degree, varying in intensity from minimal discomfort to excruciating pain prohibiting any motion of the shoulder joint. In all cases there was tenderness on pressure over the capsular area of the shoulder.

Limitation of motion was the next most frequent complaint, especially in the chronic types, where constant pain was of less frequency. Limitation of abduction of the shoulder was quite common and attempts at abduction caused considerable pain.

In approximately 55 per cent of the chronic cases the patient complained of inability to sleep comfortably; of those with acute disease, 98 per cent complained that it was impossible to sleep with the weight on the affected shoulder.

ANATOMY AND PATHOGENESIS

A bursa is a sac lined with synovial membrane; in the normal state it is collapsed and contains a small amount of synovial fluid. Bursae occur at points in the body where there is considerable motion between adjacent parts. Under ordinary circumstances they permit the required range of motion and, no doubt, serve their purpose more efficiently than would a more stable structure, such as a diarthrosis.

The subacromial (subdeltoid) bursa lies between the deltoid muscle and acromial arch above and the superior portion of the shoulder joint capsule and the greater tuberosity of the humerus below. It does not communicate with the shoulder joint. The tendons of the supraspinatus, infraspinatus, subscapularis, and teres mi-

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nor are intimately associated with the bursa, and there is a close relationship between diseases of these tendons, especially of the supraspinatus, and bursitis. All these tendons are attached to the shoulder joint capsule, over which the subacromial bursa hovers as a cap.

We consider the subacromial bursa as a single unit, though it may sometimes have a delicate partition, completely or partially separating the subdeltoid and subacromial divisions; it may also have a subcoracoid extension, leading to the erroneous impression that a separate subcoracoid bursa exists. In clinical work it seems inadvisable to attempt to distinguish between inflammation of the various divisions of the bursa, especially since it is unlikely that one division could be involved without involvement of the others (2).

The function of the subacromial bursa is to facilitate movement of the greater tuberosity of the humerus under the acromion in abduction of the shoulder (Fig. 1). It also comes into play in rotation of the humerus, and this motion is usually impaired with bursitis.

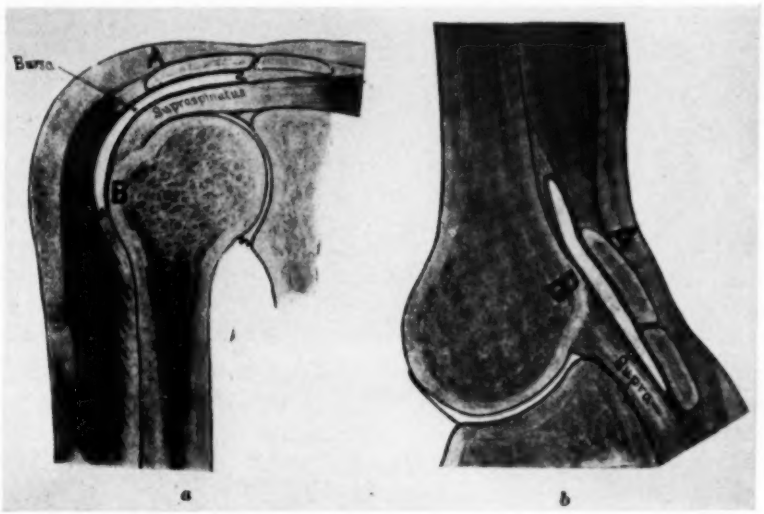

Fig. 1. Diagram illustrating the relationship of the subdeltoid bursa, supraspinatus tendon, and the acromion in (*a*) adduction and (*b*) abduction. From Codman: The Shoulder. Thomas Todd & Co., 1934.

The bursa fails in its function in the presence of inflammation or sequelae of inflammation (fibrosis and/or calcification). In the acutely inflamed bursa hydrops usually develops, manifested by regional swelling. The inflammation and acute distention of the bursal sac result in severe and unmitigated pain, usually more distressing at night than in the daytime. Abduction is limited because the greater tuberosity impinges against the acromion, with the distended bursa between them.

With bursitis of longer standing, the wall of the bursa becomes thickened by fibrosis, and distention with fluid may persist. Fibrosis can reach the point of complete obliteration of the bursal sac. The mass thus produced impinges against the acromion in abduction of the arm, preventing passage of the greater tuberosity beneath the acromion.

There has been much discussion concerning the location of calcium deposits in the region of the subacromial bursa. Apparently calcification occurs in the bursa or in the tendon as the terminal process of inflammation. Not infrequently, however, calcification can be demonstrated roentgen-

TABLE I: SUMMARY OF 318 CASES OF BURSITIS TREATED WITH IRRADIATION

Classification	No. of Patients	Age Range	Average age	Involved Shoulder			Sex		Results			
				Rt.	Lt.	Both	M	F	Failure	Relief 50%	Relief 75%	Relief 100%
Group I Acute: 7 days	85	20–74 years	47	47	37	1	35	50	1	6	8	70
Percentage of group									1%	7%	9.4%	82.3%
Group II Chronic: 8 days to 14 years	195	20–80 years	53	93	78	24	88	107	18	45	88	44
Percentage of group									9.5%	23%	45%	22.5%
Group III Chronic with acute exacerbation: 3 months to 9 years	38	34–62 years	52	25	13	0	18	20	2	3	9	24
Percentage of group									5.2%	7.9%	23.7%	63.2%
TOTAL	318	20–80 years	51	165 52%	128 40%	24 8%	141 44%	177 56%	21 4.4%	54 17%	105 33%	138 43.6%

ographically at the time symptoms of bursitis appear. Evidence has been presented (2) that in such instances the calcium deposition occurs in an adjacent tendon—most commonly the supraspinatus—as a result of injury or degeneration. Further injury or degeneration of the tendon results in extrusion of the calcium into the bursa, in which an inflammatory process then appears. Bosworth (1), in an excellent survey of 12,122 shoulders, reported calcium deposition in 2.7 per cent of supposedly normal individuals.

The causes of bursitis and tendinitis would seem to be legion. Here we are primarily concerned with x-ray therapy, and a discussion of the etiology will not be undertaken.

RADIATION THERAPY

Pendergrass and Hodes (6), in a comprehensive survey of irradiation of inflammatory conditions, state that the mechanism of response is primarily on the basis of an induced active hyperemia. Although we have made no such intensive investigation as to the "modus operandi," it is our belief that this is the most probable explanation.

In the earlier part of this series, our dosage varied from 140 to 200 r in air. The acute cases were given 140 r in air per treatment, while the chronic cases received 200 r. Later, however, a change was made, and a standard routine procedure was adopted for all cases, with 200 r in air per treatment as the basic dose. It was felt that this produced the best results. Treatment is given through two fields, anterior and posterior. A 10 × 10-centimeter cone is used, centered over the point of greatest tenderness, with a target-skin distance of 50 cm. The factors are: 200 kv.p., constant potential; 10 ma.; a Thoraeus filter of 0.44 mm. tin, 0.25 mm. copper, and 1.0 mm. aluminum; half-value layer of 1.9 mm. copper. With 200 r measured in air, a skin dose of 252 r (126 per cent) is given (3). At a 3-cm. depth from the anterior projection, a 102 per cent (204 r) depth dose is obtained (3). From the posterior projection, at an estimated depth of 8 cm., a 53 per cent dose (106 r) is obtained (3). (Estimated average shoulder, 11–12 cm. diameter.) Four anterior treatments and two posterior are given, resulting in a total dose in six consecutive days of 800 r in air anterior

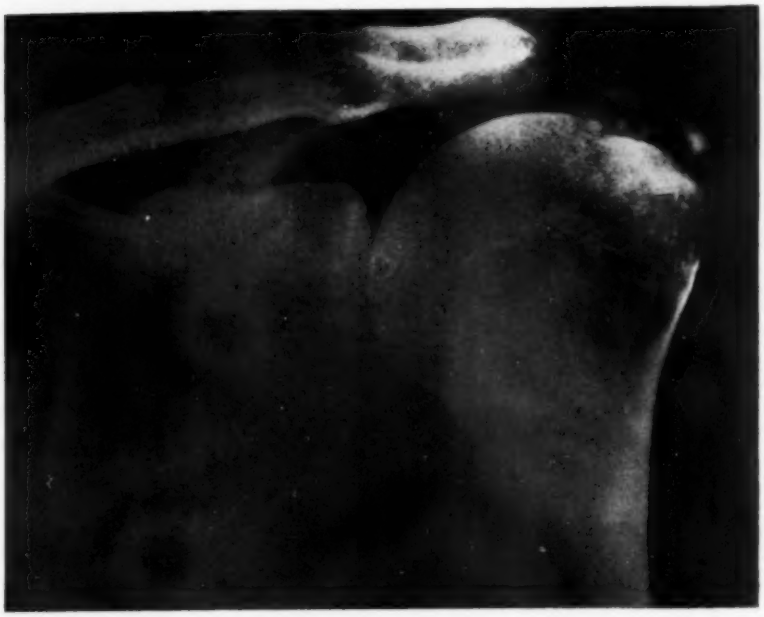

Fig. 2. W. L., age 56; no symptoms prior to acute onset. Note extensive calcification in both supraspinatus tendon and subdeltoid bursa.

Fig. 3. W. L., six days after initial treatment with complete relief of symptoms. Note diffuse haziness of calcification, with some absorption.

and 400 r in air posterior. The skin dose in the anterior field (including 34 per cent exit dose from the two posterior treatments) is 1,144 r, and in the posterior field 776 r. This gives a total depth dose at 3 cm. of 1,028 r for the entire course.

DISCUSSION

Group I, Acute: In the acute group, 85 cases with an age range of twenty to seventy-four years, and an average age of forty-seven years, were treated. Acute symptoms were of one to seven days duration. Forty-seven of the patients had involvement of the right shoulder, 37 of the left, and in one instance both shoulders were involved. Females predominated, accounting for 50 of the cases.

Seventy of the 85 patients were completely relieved of all symptoms, including tenderness on pressure, within six days. In 8, approximately 50 per cent relief was obtained. There was only one complete failure. Two of the patients had previously received shoulder irrigations with novocaine without relief; both were completely relieved by irradiation.

Group II, Chronic: The chronic group comprised 195 cases with intermittent symptomatology, ranging from eight days to fourteen years in duration. The age range was twenty to eighty years, with an average of fifty-three. Ninety-three of this group had right shoulder involvement, in 78 the left shoulder was involved, and in 24 patients the condition was bilateral. Again, as in the acute group, there was a greater proportion of females, 107 to 88 males.

Of 195 cases in this classification, 18 failed entirely to respond to treatment; 45 patients were approximately 50 per cent improved, and 88 were 75 per cent relieved, while 44 obtained complete relief of all symptoms.

In 46 of the chronic cases calcium deposition was demonstrated on radiographic examination. Nine of these patients were completely relieved of symptoms, 21 were 75 per cent relieved, 9 were 50 per cent improved, and there were 7 failures.

Twelve of the group had been previously irrigated. Of these, 1 was completely relieved, 4 were 75 per cent improved, and 6 were 50 per cent improved, with only 1 failure. One of those with 75 per cent improvement had been irrigated twice.

Group III, Chronic with Acute Exacerbation: Thirty-eight patients ranging in age from thirty-four to sixty-two years, with an average age of fifty-one, were treated. Chronic symptoms had been present for periods of three months to nine years, with an acute episode of less than seven days duration. Of the 38 patients, 25 had right shoulder involvement and 13 left. There were 20 females and 18 males.

There were 2 complete failures of treatment in this group; 3 patients experienced 50 per cent relief and 9 had 75 per cent relief; 24 of the 38 obtained complete relief of all acute symptoms. The percentage of complete relief is thus 63 per cent; 87 per cent of the patients were 75 per cent or more relieved.

In determining the results as given above, the patient was placed in a definite category as to response at the end of the sixth day, *i.e.*, failure, 50 per cent, 75 per cent, or 100 per cent improved. This type of classifying is, of course, subject to question, since it is primarily a subjective classification. It was felt, however, that with careful evaluation and discussion with the patient a definite consistent conclusion could be ascertained. Even though at a later date, often within one or two weeks, further clinical improvement was reported by the patient, no change was made in our original classification.

In approximately 40 per cent of the cases, the pain was moderately intensified for eighteen hours following the first treatment. After the second treatment, a definite improvement was usually noted, but even though practically all symptoms had disappeared by the fifth daily treatment, we still insisted upon completion of the full six-treatment course. In an occasional patient no improvement was noted until four treatments were given. We have observed the gradual reabsorption of calcium deposits over several days. In a recent publication, Roxo Nobre (8) presented some excellent films of such an occurrence.

Notwithstanding the fact that some orthopedic specialists (4) consider irradia-

tion of little or no value, we feel that it is of very definite benefit; certainly the large number of cases that are referred to radiologists for such treatment is an indication of its success.

The follow-up treatment is very important, especially in the chronic cases. Often after two weeks, when some residual tenderness remains, one additional treatment will completely relieve the symptoms. Probably an inadequate or incomplete course of therapy is the reason for the primary failure in these cases (4).

SUMMARY AND CONCLUSIONS

A series of cases of non-traumatic painful shoulder treated by irradiation is reported. No attempt is made to distinguish between involvement of the supraspinatus tendon or the subdeltoid bursa, or to separate cases of peritendinitis, but the subacromial bursa and its associated tendons are considered as a single unit.

When compared with other methods of treatment, roentgen therapy was found to give equally good or even better results.

While irradiation is more effective in acute cases, it is felt that no chronic case should be refused treatment, since it is impossible to predict which patients will respond favorably, regardless of the presence of calcification, duration of symptoms or previous unsuccessful treatment by other measures, as diathermy, irrigation, etc. Calcium may already be present at the onset of symptoms. In the present series 67 per cent of the patients having chronic disease were at least 75 per cent improved, including 22 per cent who were completely relieved of symptoms.

The earlier treatment is instituted the more satisfactory the response. An adequate follow-up is essential.

It is believed that more intensive irradiation of the shoulder than is generally given is necessary.

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SUMARIO

La Radioterapia en el Dolor No Traumático del Hombro

La serie comunicada comprende casos de algias no traumáticas del hombro tratadas con la irradiación. No se trató de diferenciar la afección del tendón supraespinoso de la de la bolsa subdeltoidea, ni de separar los casos de peritendonitis, sino que se consideraron como una sola unidad la bolsa subacromial y los tendones relacionados con ella.

Comparada con otros métodos terapéuticos, la roentgenoterapia dió resultados iguales y hasta mejores, obteniendo alivio total en 70 de 85 casos agudos, 44 de 195 crónicos y 24 de 38 crónicos con exacerbaciones agudas.

Aunque la irradiación es más eficaz en los casos agudos, no parece que deba rehusarse su empleo en ningún caso crónico, por ser imposible predecir qué enfermos responderán favorablemente, independien-

temente de la presencia de calcificación, duración de los síntomas o previos fracasos de otras medidas terapéuticas, como son la diatermia, la irrigación, etc. Al iniciarse los síntomas, ya puede haber calcio presente. En la serie actual, 67 por ciento de los enfermos crónicos mejoraron a lo menos 75 per ciento.

Mientras más pronto se aplica el tratamiento, más satisfactoria es la respuesta. Un período adecuado de observación subsiguiente resulta indispensable.

Parece que se necesita una irradiación más intensa del hombro que la administrada generalmente. Los AA. se proponen administrar en seis días consecutivos una dosis profunda total de 1,028 r a 3 cm., suministrando cuatro tratamientos por una puerta anterior y dos por otra posterior, representado 1,200 r al aire.

The Significance of Calcification in Pulmonary Coin Lesions[1]

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CURRENT INTEREST in the management of isolated solid circumscribed densities (1) within the lung parenchyma (pulmonary "coin" lesions), usually found on routine examination, prompts us to report our experiences with a group of such lesions within which calcification was demonstrated roentgenographically. Thirteen such cases have been found among a large number of pulmonary coin lesions gathered, for the most part, from the chest clinics under the direction of the Bureau of Tuberculosis, Department of Health, New York City.

OBSERVATIONS

In 5 cases, the coin lesion was excised. Two lesions showed concentric growth over a period of several years. Both patients at first rejected the idea of operative intervention but finally agreed to it after much persuasion. The outstanding features of this group are outlined in Table I. None of the 5 lesions was malignant.

TABLE I: PULMONARY COIN LESIONS WITH CALCIFICATION WHICH WERE EXCISED

Case No.	Age at Time of Discovery (years)	Sex	Date of Discovery	Date of Operation	Radiographic Findings	Diagnosis Based on Operative Findings	Remarks
1	18	M	February 1946	February 1950	Coin lesion 2 cm. in diameter, with multiple calcifications, left lower lobe. Mass adjacent to left heart border (Fig. 1A) Marked increase in size 4 years later (Fig. 1B)	Hamartoma and thymic cyst	Operation advised in 1946 but refused.
2	46	M	March 1944	June 1950	Coin lesion 3 cm. in diameter, with multiple calcifications, right lower lobe (Fig. 2A) Definite increase in size during next four and a half years (Fig. 2B)	Hamartoma	Operation refused when increase in size was first noticed.
3	55	M	October 1949	January 1950	Coin lesion 3.5 cm. in diameter, with multiple calcifications, right lower lobe (Fig. 3)	Hamartoma	
4	51	M	February 1948	April 1948	Coin lesion 2 cm. in diameter, with central calcification, right middle lobe (Fig. 4)	Tuberculoma	
5	29	M	July 1946	November 1947	Coin lesion 2.5 cm. in diameter, with central calcifications, right upper lobe. Gradual increase in size over period of 16 months	Tuberculoma	

In the remaining 8 patients, the pulmonary coin lesions were observed to remain unchanged for periods varying from two to twelve years. The pertinent facts concerning this group are outlined in Table II. None of the patients developed signs or symptoms of malignant disease.

All 13 patients were asymptomatic.

[1] From the Bureau of Tuberculosis, Department of Health, 125 Worth Street, New York, N. Y. Accepted for publication in June 1951.

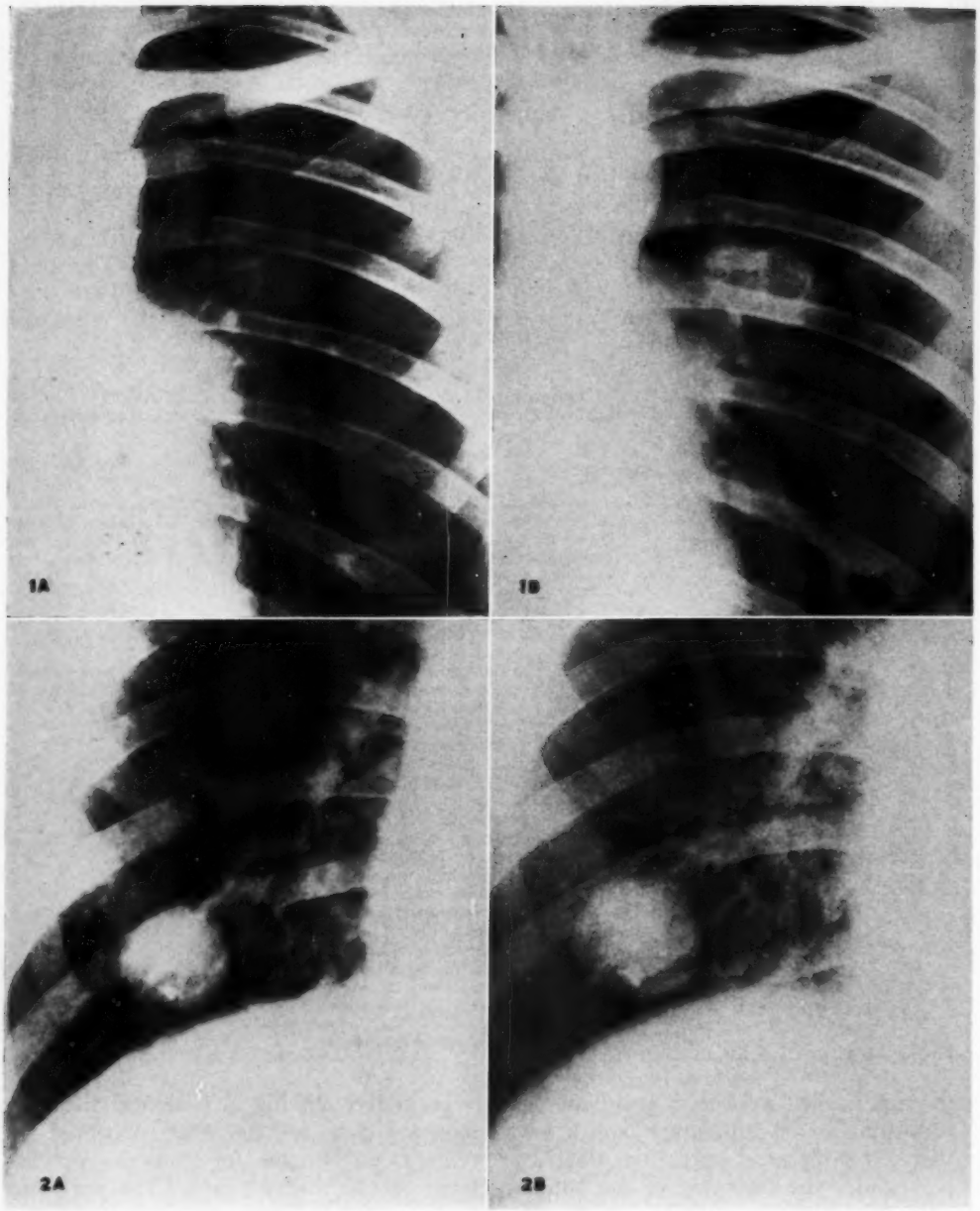

Fig. 1. Case 1. A. Eighteen-year-old male. February 1946: Oval density with calcification next to left hilus and mass in left hilar area.
B. November 1949: Marked enlargement of the density in the left mid-lung field. *Diagnosis:* Hamartoma, left lower lobe, and thymic cyst.
Fig. 2. Case 2. A. Forty-six-year-old male. March 1944: Coin lesion with calcification in right lower lobe.
B. March 1947: Marked concentric increase in size of lesion. *Diagnosis:* Hamartoma.

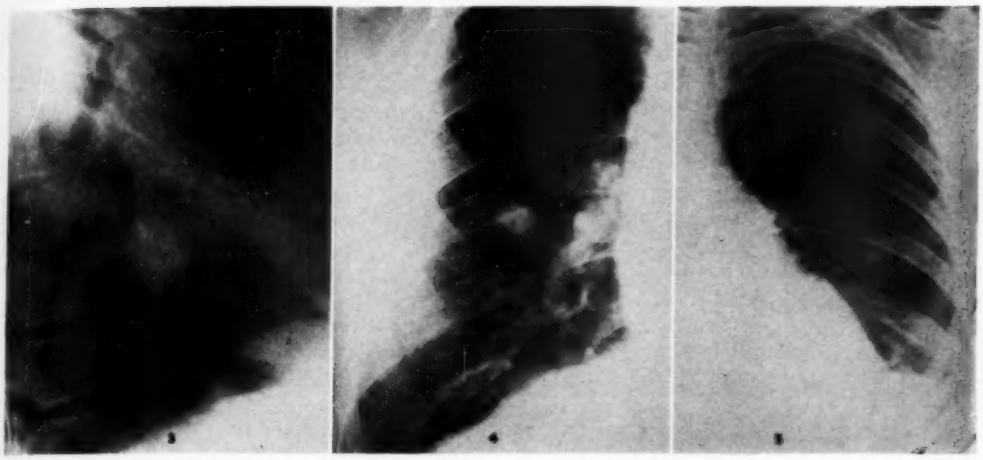

Fig. 3. Case 3. Fifty-five-year-old male. Right lateral view, showing coin lesion with multiple calcifications in right lower lobe. *Diagnosis:* Hamartoma.
Fig. 4. Case 4. Fifty-one-year-old male. Coin lesion with central calcification in right middle lobe. *Diagnosis:* Tuberculoma.
Fig. 5. Case 6. Forty-one-year-old female. Coin lesion with irregular central calcification in left lower lung field. No change in two years.

TABLE II: PULMONARY COIN LESIONS WITH CALCIFICATION OBSERVED FROM TWO TO TWELVE YEARS WITHOUT CHANGE

Case No.	Age at Time of Discovery (years)	Sex	Date of Discovery	Date of Last Examination	Period of Observation in Years	Radiographic Findings
6	41	F	February 1949	February 1951	2	Coin lesion 2 cm. in diameter, with irregular central calcification lower left lobe (Fig. 5)
7	61	M	February 1947	December 1950	3½	Coin lesion 3 cm. in diameter with central calcification right middle lobe (Fig. 6)
8	69	M	May 1946	December 1950	4½	Coin lesion 3 cm. in diameter, with central calcification right upper lobe (Fig. 7)
9	49	M	December 1946	April 1951	4½	Coin lesion 3 cm. in diameter, with multiple calcifications, left parahilar region.
10	37	M	September 1945	January 1951	5½	Coin lesion 3 cm. in diameter, with multiple calcifications, left upper lobe.
11	46	M	December 1942	January 1950	7	Coin lesion 4 cm. in diameter, with multiple calcifications, left lower lobe (Fig. 8)
12	27	M	February 1941	January 1951	10	Coin lesion 4 cm. in diameter, with calcific rim, left lower lobe.
13	40	M	March 1938	June 1950	12	Coin lesion 2.5 cm. in diameter, with eccentric calcification, right upper lobe.

Eight patients were over forty years of age. Twelve were males.

DISCUSSION

Our observations lend support to the opinion, already expressed by others, that the demonstration of calcification within a coin lesion may be considered as strong evidence that the lesion is not malignant (2). It follows, therefore, that the generally accepted policy of routine excision of solid circumscribed pulmonary lesions (3) should not be applied to coin lesions with calcification. While we are well aware of rare cases of calcification within malignant lung tumors, such as bronchogenic carcinoma enveloping a calcified tuberculous focus or some forms of sarcoma, we feel that these exceptions do not warrant the routine removal of coin

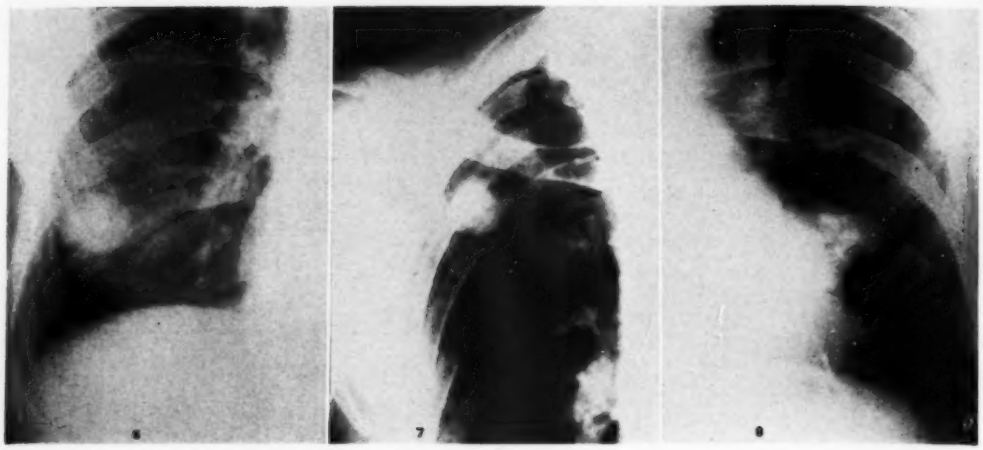

Fig. 6. Case 7. Sixty-one-year-old male. Coin lesion with central calcification in right middle lobe. No change in three and a half years.
Fig. 7. Case 8. Sixty-nine-year-old male. Coin lesion with central calcification in right upper lobe. No change in four and a half years.
Fig. 8. Case 11. Forty-six-year-old male. Coin lesion with multiple calcifications adjacent to heart. No change in seven years.

lesions with demonstrable calcification. For this reason, one should make every effort to detect the presence of calcification in all coin lesions, using sectional radiography routinely. By this means information is easily obtainable which may justify periodic supervision rather than immediate excision of accidentally discovered coin lesions in patients who represent increased operative risks.

SUMMARY

In 13 cases of pulmonary coin lesions with calcification no evidence of malignant growth was demonstrated either by operation (5 cases) or by prolonged observation (8 cases). Tomographic examination of every coin lesion is advised, since the demonstration of calcium is strongly indicative of non-malignant disease. Such information may be of considerable assistance when one must weigh the risk of operation against the hazard of periodic observation in the management of the individual case.

ACKNOWLEDGMENT: We express our appreciation to Mr. Valentin Gill for the preparation of the photographic material. We are grateful, also, to the many physicians and the members of the staffs of hospitals in New York City who assisted us in obtaining follow-up reports.

ADDENDUM: Since submitting this paper, the authors have observed another case in which a coin lesion, with a clearly demonstrable calcific center, showed considerable concentric growth between March 1948, when it was first detected on a survey examination, and June 1951, when it was excised. Histologic study showed it to be a tuberculoma.

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SUMARIO

El Significado de la Calcificación en las Lesiones de Aspecto de Monedas en los Pulmones

En 13 casos de lesiones pulmonares con calcificación parecidas a monedas, no revelaron signos de malignidad ni la operación (5 casos) ni la observación prolongada (8 casos). Recomiéndase el examen tomográfico de toda lesión de aspecto de monedas, pues la observación de calcio indica elocuentemente afección no maligna. Esa información pude resultar de mucha ayuda cuando hay que contrapesar el riesgo que entraña la operación con las perplejidades de la observación periódica.

Roentgen Manifestations of Acute Intermittent Porphyria[1]

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ACUTE INTERMITTENT porphyria, the common expression of a familial metabolic disease, is characterized by attacks of severe colicky abdominal pain in association with obstipation. The pain is often the presenting complaint or is prominent among many confusing and variable symptoms. At times, widespread involvement of the central nervous system is manifest.

Undiagnosed porphyria occurs in two groups of patients having abdominal pain, the only point of difference being that in one group abdominal surgery has been performed previously and postoperative peritoneal adhesions as a cause of intestinal obstruction must be considered. The literature contains many reports of porphyria in patients who have had one or more surgical procedures for abdominal pain, without demonstration of organic disease at the time of operation. The list of diagnoses entertained preoperatively includes almost every surgical condition of the abdomen, especially intestinal obstruction, appendicitis, and cholecystitis (1–3).

The patients of the second group have had no abdominal operations and often give a history of previous attacks of abdominal pain without a satisfactory diagnosis. Some are discharged from the hospital as psychoneurotic after extensive study to exclude organic disease.

The correct diagnosis of porphyria is made in most cases of the types reported above by chance observation that the urine is dark or by the development of neurological symptoms to produce a picture suggesting porphyria to the attending physician or a consultant (4–6). Roentgenograms of the abdomen have been obtained in many of these cases and gaseous distention of the intestine is frequently mentioned (7, 8). This is particularly true of cases with multiple roentgenograms of the abdomen made during two or more hospital admissions for abdominal pain.

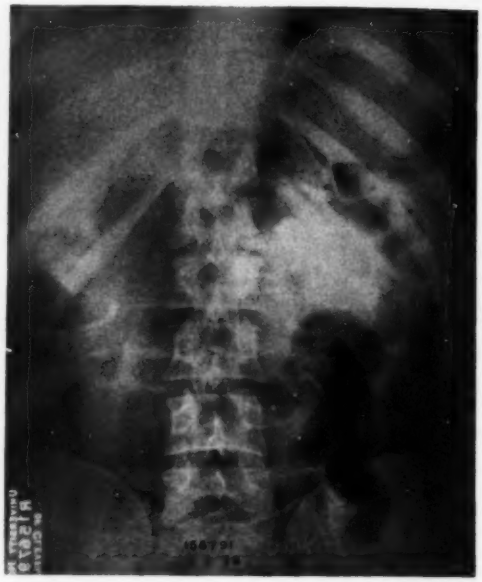

Fig. 1. Case I: Roentgenogram of abdomen several days after onset of abdominal pain, showing gaseous distention of several loops of jejunum and ileum and of the right half of the transverse colon.

Many of the reports do not include a satisfactory description of the films. The present study was initiated to determine the value of abdominal roentgenograms in the diagnosis of acute intermittent porphyria. Seventeen cases and more than 100 proto-

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Opinions expressed herein are those of the authors and do not necessarily represent the views of the Bureau of Medicine and Surgery, Navy Department.

cols provided the study material. Three cases are reported to illustrate the roentgenographic manifestations, as well as the confusing clinical aspects of this bizarre disease.

CASE REPORTS

CASE I: A 36-year-old white male received barbiturates for sedation and anesthesia for a minor surgical procedure. Abdominal pain, constipation, and distention appeared postoperatively. Roentgenograms of the abdomen showed scattered and segmental distention of the small intestine (Fig. 1).

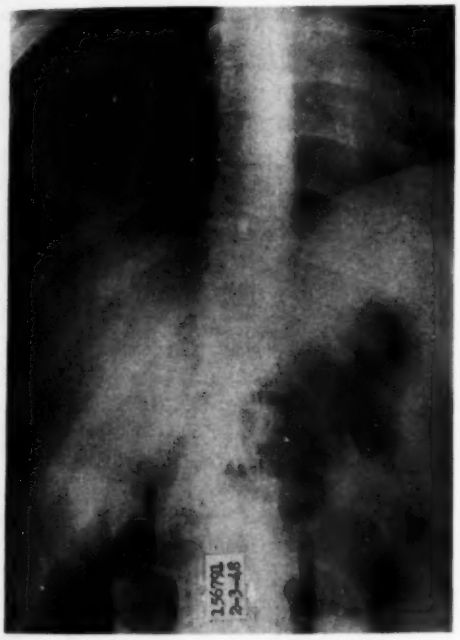

Fig. 2. Case I: Lateral view of abdomen illustrating fluid level formation.

Fluid levels were demonstrable on a lateral view (Fig. 2). The dilated loops of bowel presented a different pattern twenty-four hours later, but the degree of distention was essentially the same.

The subsequent course included an abdominal laparotomy (no pathological findings), extreme mental confusion, flaccid quadriplegia, and an eventual diagnosis of conversion hysteria. A diagnosis of acute porphyria was proposed when "red urine" was noted during another attack.

CASE II: A 22-year-old white female complained of pain in the right lower abdominal quadrant, weight loss, nervousness, and "anesthesia" for a period of one year. She had frequent crying and fainting spells. The origin of the pain was obscure, as was the significance of an abdominal "tumor"

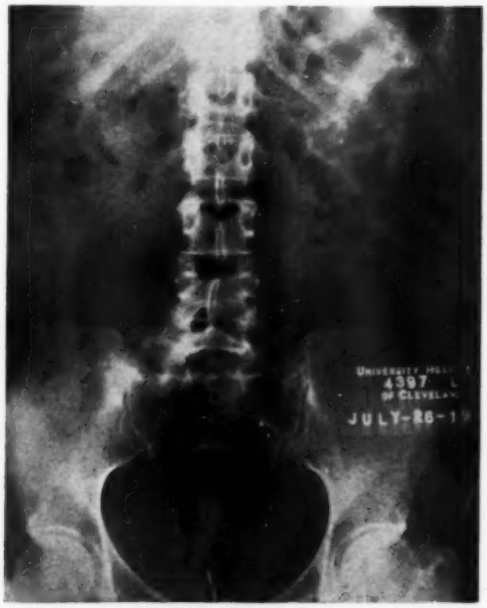

Fig. 3. Case II: Roentgenogram of the abdomen, showing gaseous distention of a long segment of jejunum and shorter segments of the ileum; scattered gas in cecum, where a mass was suspected clinically.

which was quite easily palpable at times but was absent on other examinations. A roentgenogram of the abdomen showed moderate gaseous distention of several loops of intestine (Fig. 3).

At laparotomy, the "tumor" was found to be cecum filled with fecal material; the appendix (normal) was removed. The patient was discharged, unrelieved of her symptoms.

Preoperative study had revealed the presence of dark (red) urine and tests for porphobilinogen were positive. The combination of dark urine, abdominal pain, obstipation, and emotional instability, on review of the case, led to a correct diagnosis of porphyria. The full significance of this diagnosis was appreciated only after a negative laparotomy.

CASE III: A 24-year-old white female complained of colicky abdominal pain, headache, and "nervous spells." At times the clinical picture was almost wholly that of peripheral neuritis; on other occasions, hypertension was the principal finding. The patient was admitted to the hospital with a provisional diagnosis of porphyria, on the basis of two positive tests for abnormal porphyrins. Roentgenograms of the abdomen showed a pattern of scattered segmental distention (Fig. 4).

ROENTGENOGRAPHIC FINDINGS

A study of the roentgenograms of 6 cases of acute porphyria seen at the University

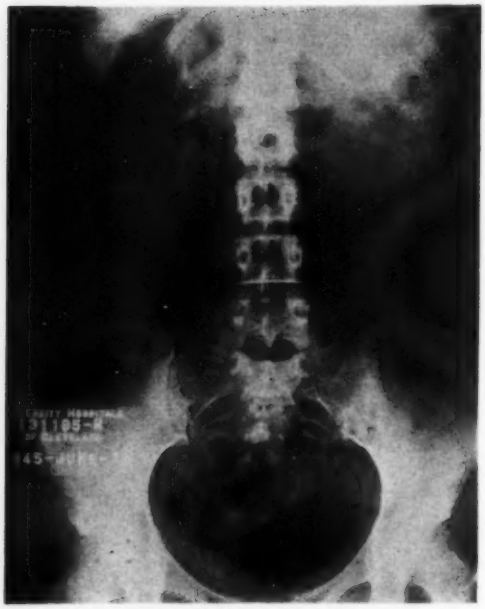

Fig. 4. Case III: Abdominal roentgenogram of patient with colicky abdominal pain due to acute porphyria. Segmental gaseous distention of small intestine and colon.

Hospitals of Cleveland and an additional case from the U. S. Naval Hospital, Newport, R. I., disclosed segmental gaseous distention of the small intestine in four instances. A review of 10 other cases seen by one of us (G.L.C.) and a survey of more than 100 case reports in the literature indicate that at least 50 per cent of patients with abdominal pain due to acute porphyria have similar distention of the gastro-intestinal tract. The appearance of the abdominal roentgenograms in acute porphyria varies from day to day; a continuous dilated loop of intestine may appear in the upper half of the abdomen on one film and be replaced by a scattered pattern of dilated loops a few hours later. A typical "ladder pattern" of mechanical obstruction of the intestine does not commonly develop. Fluid levels were demonstrable in two of four cases examined recently.

The colon exhibited no significant dilatation in four cases but was greatly dilated with gas and fecal material in two patients. The distention of the cecum in another case was clinically misinterpreted as an abdominal mass. Laparotomy was performed, at which time intestinal dilatation was widespread and "the mass" was identified as cecum, filled with feces.

The gastro-intestinal manifestations of acute porphyria have been attributed to scattered areas of smooth muscle spasm and intervening dilatation of the intestine with resultant pain and tenderness. Local or generalized spasm of the small intestine and of the cecum have been observed during laparotomy (7). Experimental evidence has demonstrated smooth muscle spasm of the intestine when a segment was perfused by a very dilute solution of coproporphyrin (8, 9). Watson suggests that there may be a close relationship between the presence of porphobilinogen and the occurrence of abdominovisceral symptoms (15).

CLINICAL CHARACTERISTICS OF PORPHYRIA

The clinical and biochemical aspects of porphyria are discussed in the excellent papers of Watson and Larson, Hayman, and Welcker (4, 10, 11). Case reports by Calvy, Little and Palmer, and Berg illustrate typical findings of acute porphyria (1, 5, 6, 12). Three clinical types are recognized:

1. Light-sensitive.
2. Acute intermittent.
3. Mixed, with characteristics of Types 1 and 2.

The *light-sensitive* type is rare but presents striking signs. Infants or young children may exhibit hemolytic anemia, hepatosplenomegaly, pigmentation of the teeth (erythrodontia) and of bone or cartilage. Hirsutism and photosensitivity of exposed skin, with the appearance of bullous lesions and scarring, are other features. Red urine is always present.

Acute intermittent porphyria is the common form of the disease and its onset is frequently associated with recent infection, fatigue, trauma (either physical or psychological), the puerperium, or the use of

barbiturates, sulfonamides, or alcohol. The patient is usually emotionally unstable and gives a history of vague gastro-intestinal upsets and periodic illness. An abdominovisceral crisis with signs of intestinal obstruction may usher in an episode of acute porphyria; again, the patient may present a picture of a neurological disorder. The urine may be dark or mahogany colored; at times it appears normal at passage but darkens after prolonged exposure to light. The test for porphobilinogen is positive in these urine samples.

Mixed porphyria may present abdominal involvement and moderate photosensitivity, but the emotional and neurological changes are mild.

DIAGNOSIS

The diagnosis of acute intermittent porphyria depends upon the demonstration of porphobilinogen (or abnormal porphyrins) in the urine (and feces). The Watson-Schwartz test for porphobilinogen is a modification of the familiar Ehrlich test for urobilinogen, but differs essentially in that chloroform is added to separate porphobilinogen, which then remains in the aqueous fraction, its presence being indicated by a pink-purple color (13).

It is to be emphasized that the roentgenographic appearance of the abdomen of patients with acute porphyria is not sufficiently characteristic to permit a positive diagnosis. Porphyria must be considered, nevertheless, in the differential diagnosis of patients with *obscure* abdominal pain, and particularly in those cases with segmental gaseous distention of the intestine.

Berlin and Cotton call attention to the fact that no portion of the gastro-intestinal tract may escape involvement (14).

DISCUSSION

The differential diagnosis of abdominal pain is a problem which radiologists frequently discuss with clinicians, and careful study of abdominal roentgenograms often yields valuable information leading to a correct diagnosis. A significant number of cases with mild to severe abdominal pain and gaseous distention of the small intestine remain undiagnosed in spite of extensive radiographic, laboratory, and clinical studies, including passage of a Miller-Abbott tube to exclude mechanical obstruction of the intestine. In the past this group has included cases of acute intermittent porphyria, the cases reported above being typical examples.

The first essential in making a correct diagnosis of porphyria is to be aware of the disease. The radiologist, as a consultant, should realize that acute porphyria is one of the possibilities to be mentioned in the study of patients with obscure abdominal pain, especially if serial roentgenograms of the abdomen demonstrate segmental gaseous distention of the small intestine varying in appearance from day to day without progressing to the picture of intestinal obstruction. It is important, also, for the radiologist to know that the patient may have abdominal pain due to acute porphyria with a normal roentgenographic picture.

SUMMARY

1. A study of 17 cases of acute intermittent porphyria and a review of the literature indicate that at least 50 per cent of the patients have segmental gaseous dilatation of the intestine.

2. The appearance of abdominal roentgenograms varies from day to day and there is no "pattern" that is characteristic of the disease. Short distended segments of intestine which change in appearance on serial films are seen most frequently; a longer dilated segment is occasionally observed. Fluid levels develop. The colon, especially the cecum, may be dilated.

3. Spasm and gaseous dilatation of the gastro-intestinal tract explain the abdominal pain as well as the roentgenographic manifestations of acute intermittent porphyria.

4. While a diagnosis cannot be made solely on the basis of the roentgen picture, it is important for the radiologist to be acquainted with the changes which may occur, since mention of this disease in the

differential diagnosis of "problem cases" will suggest the simple laboratory test that is conclusive.

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SUMARIO

Manifestaciones Radiográficas de la Porfiria Intermitente Aguda

El estudio de 17 casos de porfiria intermitente aguda y un repaso de la literatura indican que por lo menos 50 de los enfermos muestran dilatación gaseosa de segmentos del intestino.

El aspecto de las radiografías abdominales varía de día en día, sin "patrón" típico de la dolencia. Lo más frecuente es observar segmentos cortos distendidos del intestino cuyo aspecto varía en las radiografías seriadas; de cuando en cuando se observa dilatación de un segmento más largo. Se forman niveles de líquido.

El espasmo y la dilatación gaseosa del tracto gastrointestinal explican la ocurrencia de dolor abdominal en esos enfermos así como las manifestaciones radiográficas de la afección.

Aunque no puede hacerse el diagnóstico exclusivamente a base del cuadro roentgenológico, es importante que el radiólogo esté al tanto de las alteraciones que pueden sobrevenir, dado que la mención de porfiria en el diagnóstico diferencial de los "casos dudosos" indicará la sencilla prueba de laboratorio que resulta terminante.

Methocel-Diodrast: A Viscous Water-Soluble Contrast Medium for Bronchography

Roentgen and Clinical Results in 23 Cases[1]

EMANUEL SALZMAN, M. D., MORDANT E. PECK, M. D., F. A. C. S., and A. J. NEERKEN, M. D.

RETENTION BY the lungs, interfering with the interpretation of follow-up chest films, and insolubility in the bronchial secretion are the most serious objections to the use of iodized oils as contrast media in bronchography. To overcome these disadvantages, several water-soluble contrast media have been proposed. In general, these consist of iodopyracet (3,5-diiodo-4-pyridone-N-acetic acid diethanolamine) and a thickening agent in the form of a cellulose derivative. Iodopyracet is known in America as diodrast (Winthrop-Stearns), in Sweden as umbradil (Astra), and in Switzerland as ioduron (Cilag).

Water-soluble, absorbable contrast media have been substituted for the iodized oils in bronchography by several workers. In 1935 Taylor and Bobrowitz (9) used a solution of 35 per cent diodrast for this purpose. Due to the low viscosity of the medium, marked alveolar filling occurred, obscuring the shadows of the bronchi.

Morales and Heiwinkel (7) in 1948 described the use of viscous umbradil (an aqueous solution containing 50 per cent iodopyracet, 2.6 per cent carboxymethylcellulose, and 0.5 per cent xylocaine) in bronchography. In the same year Fischer (3) reported on a similar contrast medium, ioduron B. Both preparations have been studied experimentally and have had extensive clinical trial in Europe. In the lungs of rats and rabbits receiving intrabronchial injections of viscous umbradil, Hellström and Holmgren (5) found nonspecific pulmonary changes which could be reproduced with injections of normal saline. The umbradil was apparently absorbed from the lungs into the blood stream. The carboxymethylcellulose was partially expectorated and partially ingested by alveolar phagocytes, as demonstrated histologically by the staining of the colloid with toluidine blue. After three weeks, the reaction in the lungs had almost entirely disappeared. It was suggested that the carboxymethylcellulose ingested by the phagocytes is split into smaller molecules and absorbed. No definite pathological changes were noted in the livers and kidneys of the animals studied. Recently, Atwell and Pedersen (1) reported on the clinical use of viscous umbradil for bronchography in 3 cases and concluded that the material was preferable to the iodized oils for this purpose.

We have ourselves reported experimental studies and initial clinical results in 3 cases in which an aqueous solution of diodrast and methylcellulose—methocel-diodrast—was used as a contrast medium in bronchography (8). Our purpose here is to present the roentgen and clinical findings in 23 patients studied bronchographically with this preparation.

Methocel-diodrast is an aqueous solution of 50 per cent diodrast and 1.75 per cent methylcellulose (Dow Chemical Co.) of approximately the same viscosity (4,000 cps.) as the iodized oils. Methylcellulose (2) is a water-soluble cellulose ether derived from purified cotton or wood cellulose of the formula R—O—CH_3. Curiously, the substance is soluble in cold water but insoluble in hot water.

Hueper and Ichniowski (4) gave methylcellulose solutions intravenously to dogs in a dosage of 2.5 gm. per kilogram of body weight to combat shock, and were unable to detect any histologic change in the tissues of the animals studied. This dose is

[1] From the Department of Radiology (Dr. Salzman) and the Department of Surgery (Dr. Peck and Dr. Neerken), Denver General Hospital and the University of Colorado School of Medicine, Denver, Colo. Accepted for publication in May 1951.

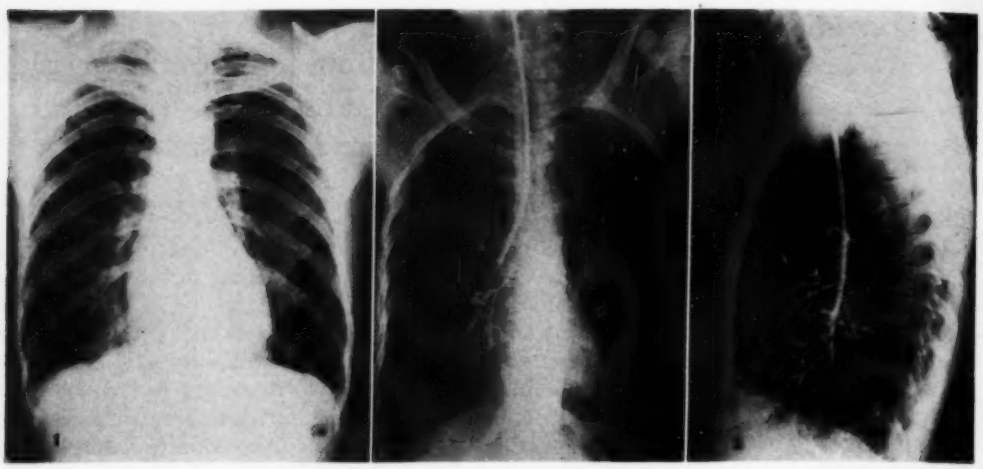
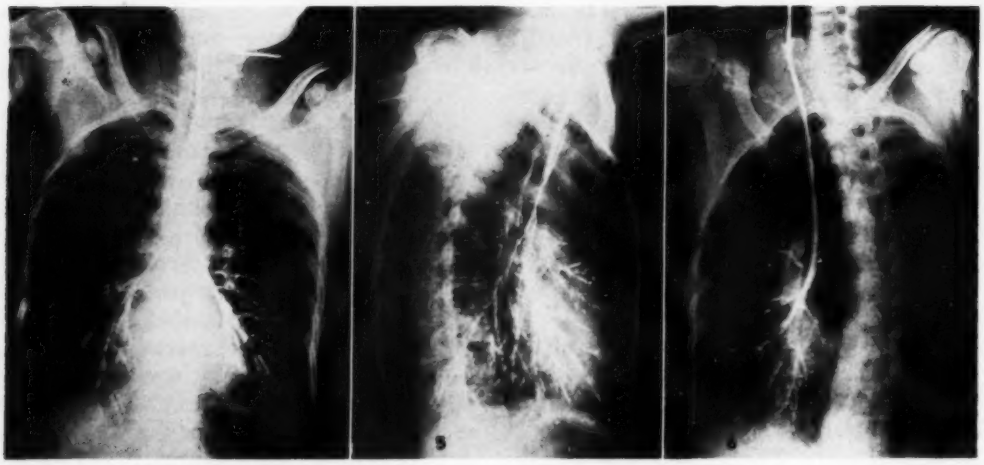


Fig. 1. Chest film prior to bronchography.
Figs. 2 and 3. Bronchograms after filling of right bronchi.



Figs. 4–6. Bronchograms after filling of bronchi in both lungs.

approximately fifty times the amount used for a methocel-diodrast bronchogram. Given intravenously, in larger doses, the colloid is retained by the reticulo-endothelial system. There is evidence to indicate that methylcellulose is excreted by the kidneys and the intestinal and bronchial mucosa. In our preliminary experiments the lungs of guinea-pigs and dogs were studied after bronchography with methocel-diodrast. Transient foci of atelectasis and bronchopneumonia were found. A higher incidence of similar changes was noted after iodized oil bronchography. Histologic sections of the lungs stained specifically for methylcellulose failed to reveal any evidence of this substance. In these experiments the diodrast was observed to be rapidly absorbed from the lungs and excreted by the kidneys.

Since July 1950, we have used methocel-diodrast as a routine contrast medium for bronchography. An intradermal skin test with 0.1 c.c. of 35 per cent diodrast is made prior to the examination in an attempt to exclude sensitivity, though we recognize

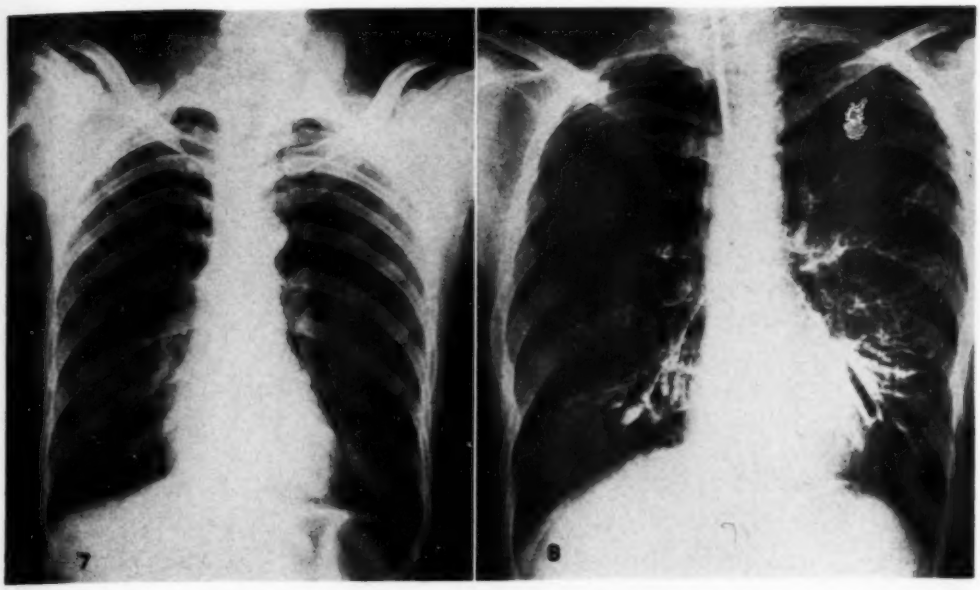
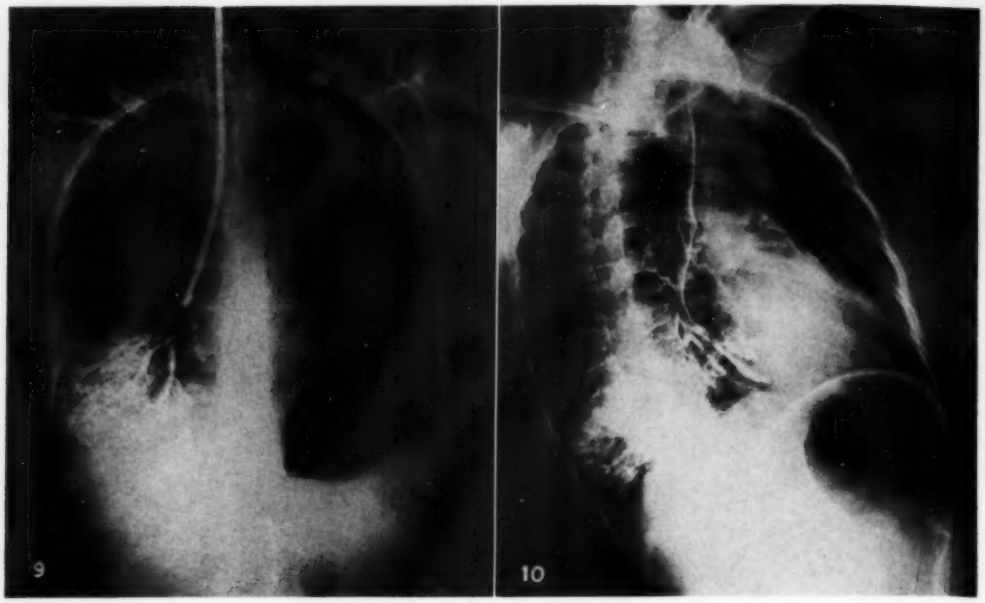


Fig. 7. Chest film twenty-four hours after bronchography.
Fig. 8. Bronchogram showing bilateral bronchiectasis.

that skin sensitivity may not be a reliable index of total body allergy. In one case, because of a marked skin reaction to diodrast, a methocel-diodrast bronchography was not performed. The patients are prepared with atropine gr. 1/150 forty-five minutes prior to the examination and 50 to 100 mg. of seconal intravenously five to ten minutes before the examination. The pharynx, larynx, trachea, and bronchi are thoroughly anesthetized with 5 per cent cocaine. A catheter is passed through the mouth into the trachea, the tip resting just above the carina. The position of the catheter is checked fluoroscopically; 15 c.c. of methocel-diodrast is injected and, by positioning, the bronchi in one lung are filled. Postero-anterior and lateral films of the filled lung are made (Figs. 2 and 3). The bronchi in the opposite lung are then filled with an additional 15 c.c. of the medium and postero-anterior and both oblique films are obtained (Figs. 4–6). The bronchi in both lungs are usually outlined at one sitting. Postural drainage is not done routinely.

The shadows of the bronchi remain sharp for three or four minutes after the instillation of methocel-diodrast. After longer intervals, the outlines are blurred as the material is absorbed by the bronchial mucosa. Because of this rapid absorption, it may be advisable to do all filming with a spot-film device, as recommended by Fischer. Normal lungs are clear radiographically of contrast medium one hour after the bronchogram has been completed. Pulmonary disease, such as bronchiectasis, causes a slight delay in absorption. One hour after the bronchogram, a film of the abdomen generally shows the urinary tract irregularly outlined with diodrast.

Bronchograms obtained with methocel-diodrast are generally of excellent quality (Figs. 2–6, 8). The material tends to adhere to the mucosa of the bronchi to a greater degree than the iodized oils, outlining them in mucosal relief. The iodized oils have a tendency to fill the bronchi and thereby may obscure a small polypoid lesion. Unlike the oily media, methocel-diodrast mixes readily with the bronchial secretions, outlining bronchi partially filled with secretions (Fig. 8).



Figs. 9 and 10. Accidental injection of 15 c.c. of methocel-diodrast into lateral basal segment of right lower lobe.

In 19 of the first 23 examinations performed with this medium, the bronchograms were diagnostic; 2 patients would not co-operate, and the procedure could not be completed. In 2 instances the tip of the catheter was inserted accidentally into a tertiary division bronchus of the right lower lobe and 15 c.c. of methocel-diodrast were injected into the smaller bronchi and parenchyma of a pulmonary segment. In one of these cases a diagnostic bronchogram was subsequently obtained. In 4 patients two bronchograms were obtained outlining the same portions of the lungs. In one case, the bronchograms were done three days apart.

Mild febrile reactions (100–101°) occurred in 9 cases, lasting one day. It is our impression that similar febrile reactions follow iodized oil bronchography. Of the 2 patients in whom methocel-diodrast was injected into a segment of the right lower lobe, one had a mild febrile reaction lasting one day, with no evidence of pneumonia roentgenographically. The second patient (Figs. 9 and 10) had a clear-cut pneumonia (Fig. 11) at the site of the injection, the lateral basal segment of the right lower lobe, with clearing clinically and roentgenographically in eight days (Fig. 12). In each instance the pulmonary opacity due to the contrast medium promptly cleared. If such an injection were made with the iodized oils, one might anticipate residual densities in the lungs for months and possibly years.

Three patients had excisional lung surgery after bronchography; 2 for bronchiectasis and 1 for putrid lung abscess. The inflammatory changes in the specimens, associated with the disease, were so marked that it was difficult to evaluate a possible reaction to methocel-diodrast.

Two patients with active pulmonary tuberculosis were examined. Follow-up examinations of one of these for five months and of the second for six months failed to reveal any spread of the disease. In 9 patients follow-up films were obtained over periods of three to six months after bronchography. In none of this number were any pulmonary changes observed which could be attributed to the use of methocel-diodrast.

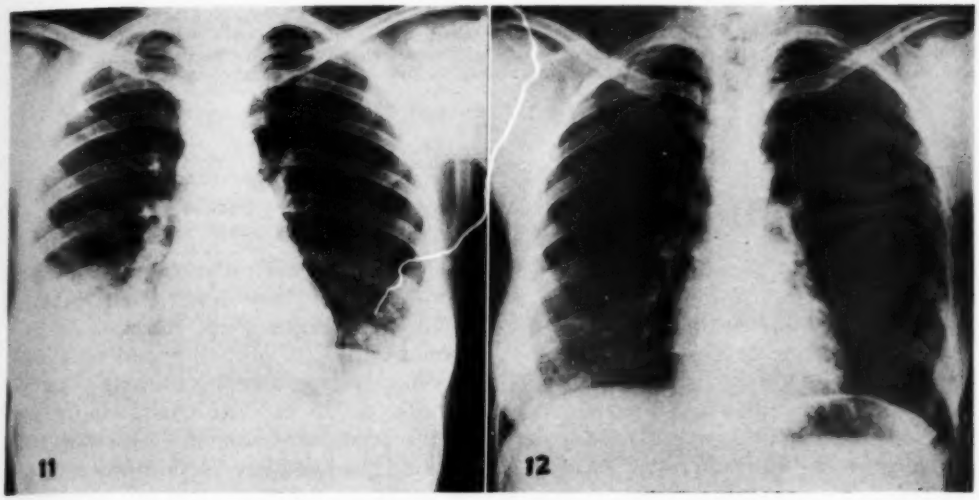


Fig. 11. Pneumonia at site of injection twenty-four hours after bronchography.
Fig. 12. Clearing of pneumonia eight days after bronchography.

SUMMARY

The roentgen and clinical results obtained with a new contrast medium—methocel-diodrast—for bronchography are described. Methocel-diodrast is an aqueous solution of diodrast and a thickening agent, methylcellulose. It is soluble in bronchial secretions and disappears rapidly from the lungs, so that patients may be followed radiographically after bronchography, and bronchograms may be repeated, without interference from retained contrast medium.

Technically satisfactory bronchograms were obtained with methocel-diodrast in 19 of 23 cases and the medium was considered preferable to the iodized oils. Febrile reactions were mild and of brief duration. In 2 patients with active pulmonary tuberculosis the procedure was without adverse effect on the disease. Injection of 15 c.c. of the medium into a pulmonary segment caused a pneumonia in one instance, which cleared promptly with antibiotic therapy. Follow-up films in 9 patients failed to reveal any changes which could be attributed to the medium.

Further clinical trial of methocel-diodrast with long-term follow-up is recommended.

ACKNOWLEDGMENT: The authors are deeply indebted to Mr. Sam Kohan, Pharmacist, Denver General Hospital, for his valuable aid in the preparation of methocel-diodrast.

ADDENDUM: Since this paper was submitted we have had one death during a methocel-diodrast bronchography. It was our impression that this death was due to a cocaine reaction. No other serious complications have occurred in more than 50 bronchographies with this medium.

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SUMARIO

Metocel-Diodrasto. Medio Hidrosoluble y Viscoso de Contraste para la Broncografía. Resultados Roentgenológicos y Clínicos en 23 Casos

Los resultados radiológicos y clínicos aquí descritos fueron obtenidos con un nuevo medio de contraste, metocel-diodrasto, en la broncografía. Trátase de una solución acuosa de diodrasto y de un espesativo, o sea, etil-celulosa. Soluble en las secreciones bronquiales, desaparece rápidamente de los pulmones, de manera que puede seguirse observando radiográficamente a los enfermos y pueden repetirse los broncogramas sin que lo impida la retención del medio de contraste.

Con el metocel-diodrasto obtuviéronse broncogramas técnicamente satisfactorios en 19 de 22 casos, considerándose el medio preferible a los aceites yodados. Las reacciones febriles fueron leves y de poca duración. En 2 sujetos con tuberculosis pulmonar activa, el procedimiento no ejerció efecto adverso sobre la dolencia. La inyección de 15 c.c. del medio en un segmento pulmonar ocasionó en un caso neumonía, que desapareció prontamente con la antibioticoterapia. Las radiografías de observación subsiguiente en 9 enfermos no revelaron alteraciones imputables al medio.

Recomiéndanse más pruebas clínicas del metocel-diodrasto con observaciones subsiguientes a largo plazo.

Pulmonary Adenomatosis (Alveolar-Cell Tumors)

A Report of Two Cases[1]

LT. COL. ROBERT W. LACKEY, MC, USA

IN RECENT YEARS there has been an increased interest in pulmonary adenomatosis. Swan (2), in a recent article, has ably reviewed the extensive literature. The questions as to whether or not the lesions represent true neoplasms, from what tissue they originate, and their etiology, are still unsolved and controversial. It is our intention to report two cases, analyze the radiologic picture, and discuss briefly the diagnosis of this condition.

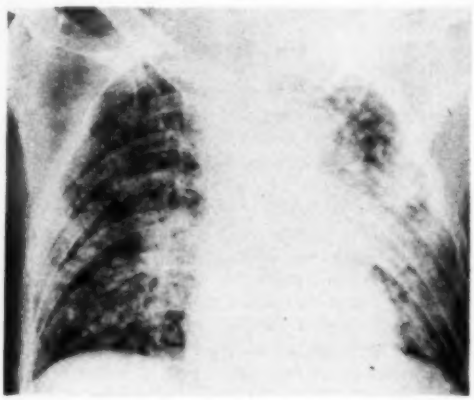

Fig. 1. Case I: Generalized nodular infiltrative process involving all lung fields.

CASE REPORTS

CASE I: A 31-year-old Filipino male was admitted to Fitzsimons Army Hospital on Aug. 16. His history dated back to April when he began to experience left-sided chest pain and left shoulder pain associated with weakness of the left arm. He consulted a private physician, who made a diagnosis of pulmonary tuberculosis and recommended hospitalization. The patient was then inducted into the Army and, because of the complaints previously described, was admitted to a station hospital on June 22, where a diagnosis of pulmonary tuberculosis and tuberculosis of the 6th cervical vertebra was made.

At the time of admission to Fitzsimons Army Hospital, in August, positive findings consisted of induration and adenopathy of the left posterior cervical nodes, together with râles generalized throughout all lung fields. Sputum smears for acid-fast bacilli were negative, as were all other laboratory studies. X-ray examination revealed a generalized nodular pulmonary infiltrate throughout all lung fields (Fig. 1). The nodules varied from 0.3 to 1.5 cm. in diameter. Their margins were hazy, and in some areas they showed a tendency to become confluent. There was a destructive process of the 6th and 7th cervical vertebrae (Fig. 2). The trachea was deviated to the right by a cervical mass.

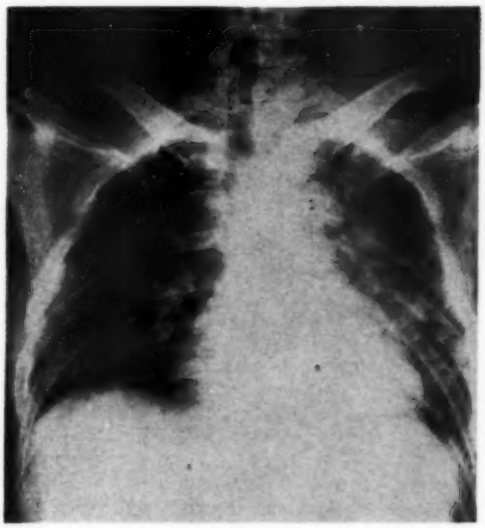

Fig. 2. Case I: Overexposed film showing destructive lesions involving the 6th and 7th cervical vertebrae and tracheal deviation to the right due to cervical and mediastinal nodes.

The hospital course was progressively downhill. On Sept. 28 a posterior cervical node was removed and microscopic examination showed metastatic adenocarcinoma. Weakness and cachexia became progressive and the patient died on Nov. 6.

Autopsy was performed eleven hours after death. Gross examination showed the pleural cavities to be free of fluid and of adhesions. The right lung weighed 840 gm., the left 755 gm. The pleurae were thin, transparent, and glistening. The

[1] From the Department of Radiology, Fitzsimons Army Hospital, Denver 8, Colo. Accepted for publication in June 1951.

general consistency of the lungs was firm, with almost complete loss of normal crepitation. The parenchyma was replaced by discrete and confluent tumor nodules. The cut surfaces showed multiple tumor foci from 0.3 cm. to 1.5 cm. in diameter, which were yellowish pink, usually discrete, and somewhat slimy, with intervening dark red lung tissue. Numerous tumor nodules encroached upon the pleura. The bronchi were traced in so far as possible with fine dissection, and in only one terminal bronchiole, 0.3 cm. in circumference, in the left lower lobe was there evidence of tumor invasion in the form of thickening and roughened nodules. This was adjacent to a larger focus, 2.5 cm., in the periphery of the lung. The vessels showed no abnormalities. The hilar nodes were enlarged and matted together. Their cut surfaces showed nodular grayish yellow infiltration.

Microscopic examination of the parenchyma showed widespread invasion by tumor tissue in discrete or confluent foci. The pattern was somewhat gland-like but also showed nests and buds, with the anaplastic cells using the alveolar walls as a framework. The latter were fibrous, thickened, congested, and frequently broken down, with the formation of cysts lined by anaplastic cells. The cells had large, oval or round, faintly basophilic nuclei with acidophilic nucleoli. Mitotic figures were numerous. The cytoplasm was abundant, granular, and neutrophilic to slightly eosinophilic. Frequently the cells formed papillary projections. Intervening lung tissue showed varying degrees of atelectasis, emphysema, passive congestion, and hemorrhage. Bronchial mucous membranes and vessels showed no abnormalities except where invaded.

Metastatic lesions were present in the hilar, superficial cervical, and peritracheal lymph nodes bilaterally; the deep cervical, supraclavicular and infraclavicular lymph nodes on the left; the meninges, brain, spine, liver and thyroid gland.

Anatomic Diagnosis: Pulmonary adenomatosis, bilateral, with metastases to the hilar, cervical and peritracheal nodes, the cerebral spinal meninges, the liver, thyroid, and bones.

Comment: In this case the alveolar walls were lined with anaplastic cells typical of the so-called alveolar-cell tumor or pulmonary adenomatosis. The process was generalized and nodular in type, distributed throughout both lungs. There was evidence of widespread metastases. The case is typical, resembling those previously reported in the literature.

CASE II: A 53-year-old white male was admitted to Fitzsimons Army Hospital on May 19. The preceding December he had contracted what was described as a typical cold, associated with a nonproductive cough, malaise, progressive anorexia, and a weight loss. A private physician made a diagnosis of bilateral pulmonary tuberculosis, and hospitalization was instituted. During the five-month period prior to admission to Fitzsimons Army Hospital, dyspnea had been gradually progressive and was associated with a 30-pound weight loss. Two sputum examinations had been reported as positive for acid-fast bacilli and the patient had been on streptomycin therapy from April 20 to May 1.

At the time of admission the patient was markedly emaciated, pale, and slightly cyanotic. There were numerous shotty nodes in the anterior and posterior cervical chains as well as in the axillary and inguinal regions. Examination revealed a respiratory lag on the right and general limitation of chest expansion, a friction rub over the left anterior chest, and flatness to percussion over both apices. The respiratory rate was 30 to 50 and there was a tachycardia of 120. One sputum examination was positive for acid-fast bacilli but all other studies were negative. X-ray examination (Figs. 3 and 4) showed an extensive nodular involvement of both hemithoraces. Infiltration was predominantly nodular, though in several areas there was diffuse coalescence of the lesions.

At no time during his stay in the hospital did the patient show a temperature elevation. He complained continually of pain in the precordial region, which responded well to codeine. Dyspnea was constant, but extreme cyanosis did not appear until May 26 when, despite supportive therapy, death occurred.

Autopsy was performed three hours after death. Gross examination showed approximately 100 c.c. of clear dark amber fluid in each pleural cavity. There were scattered, easily broken adhesions over both lungs. The right lung weighed 1,625 gm., the left 1,170 gm. The pleural surfaces were roughened, thickened, and nodular, due to multiple round subpleural lesions from 0.2 to 0.6 cm. in diameter. Both lungs were firm and did not collapse. The cut surfaces showed multiple closely packed, grayish-white tumor nodules varying from 0.4 to 1.0 cm. in diameter, with intervening dark red, slightly crepitant lung tissue. Because of the great number of tumor nodules, little lung tissue was apparent. Bronchi were dissected free, and there was no suggestion of a primary tumor site. The smaller bronchi were invaded by tumor in numerous areas.

Microscopic sections showed almost complete replacement of lung parenchyma by small nodules of tumor tissue. This was of a well differentiated papillary adenocarcinomatous type with rare mitotic figures. The cells were found lining the alveoli in many areas. Tumor cells were present in veins adjacent to nodules of tumor tissue. Sections of bronchi showed normal epithelium. Exhaustive studies failed to reveal evidence of tuberculosis.

Metastases were present in the cerebral cortex, pituitary, tracheobronchial lymph nodes, esophageal lymph nodes, diaphragm, both adrenals, both kidneys, left axillary lymph nodes, skeleton and stomach.

Anatomical Diagnosis: Pulmonary adenomatosis, bilateral, with metastases to hilar and peritracheal nodes, brain, diaphragm, adrenal glands, kidneys, bone, and stomach.

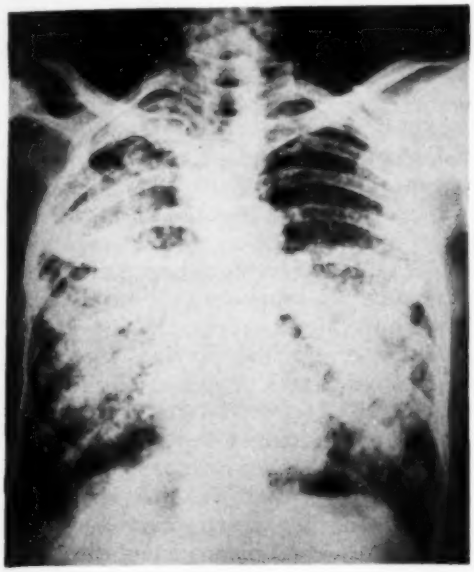

Fig. 3. Case II: Generalized nodular infiltrative process involving all lung fields. Areas of diffuse coalescence of the nodules are clearly demonstrated.

Comment: This case again demonstrates the diffuse nodular type of pulmonary adenomatosis with metastases to multiple organs. The lungs themselves showed diffuse nodose lesions throughout all areas, with a tendency towards confluence.

GENERAL DISCUSSION

Pulmonary adenomatosis or alveolar-cell tumor is a rare disease as evidenced by the fact that we have been able to collect only 74 cases from the literature up to the present time. This number includes the 25 unquestioned cases collected up to 1941 by Neubuerger and Geever (1), the 27 collected by Swan (2) between 1941 and 1949, as well as the 9 that Swan personally added.

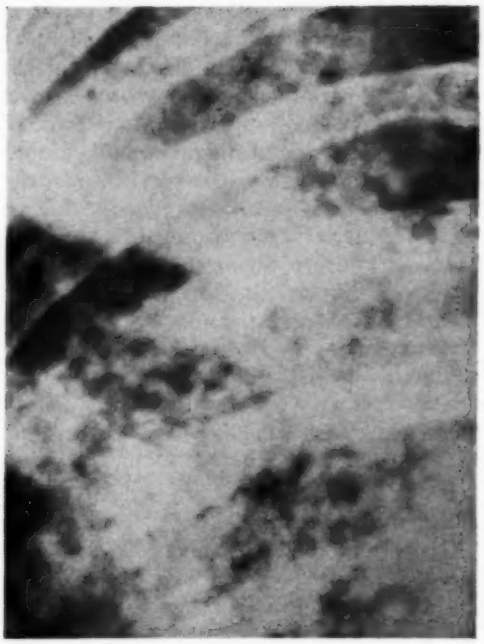

Fig. 4. Case II: Enlarged section from Fig. 3, showing the coalescence of nodules to form a diffuse process. The nodular margins of the diffuse areas are demonstrated.

As described, this disease may present itself as a nodular or diffuse process involving one lung or all of both lungs (Table I). Typically, it spreads throughout all lobes and causes death by interference with respiration, both by filling the alveoli with tumor and by the usual complication, pneumonia. Metastases are not infrequent.

The onset is usually insidious, with gradual development of cough and dyspnea. It may be precipitated by respiratory infection. In a typical case there is progression of the cough, which becomes productive, and of the dyspnea, to which cyanosis is eventually added. Copious amounts of sputum may be brought up, but it is seldom blood-streaked until late in the course. There is a progressive loss of weight, with loss of strength, anorexia, and fever. These symptoms are gradually progressive and may be prolonged for a year or more.

The radiological picture has been de-

scribed several times as of two possible types, either alone or in combination:

1. The nodular type, characterized by nodular or patchy shadows varying in size from 2 mm. to 1 cm. in diameter and widely distributed throughout both lungs.

2. The diffuse type characterized by an area or areas of homogeneous diffuse infiltrate involving a segment, a lobe, a lung, or the greater part of both lungs.

There may be radiological evidence of pleural involvement and, as previously mentioned, metastases. The incidence of these various patterns is shown in Table I.

TABLE I: PULMONARY ADENOMATOSIS. DISTRIBUTION OF LESIONS IN 76 CASES

Unilateral	17	Bilateral	59
Diffuse	37	Nodular	39
Metastasis	37	No Metastasis	39

Before we analyze these roentgen pictures in more detail, it may be well to review briefly the pathological findings which are responsible for the impressions on the films. Swan, from his review of the literature and his personal study of 9 cases, states that the histologic picture is the same in both the nodular and diffuse form, with variations in the pattern ranging from simple investment of the alveoli to complicated arrangements resulting from an intra-alveolar proliferation with ruptures of the walls and coalescence of the spaces. Grossly, too, there seems to be a somewhat basic pattern. The cut surface of the lung in the nodular variety is studded with lesions ranging in size from almost microscopic to large tumor foci coalescing to form still larger areas occupying almost an entire lobe. The diffuse form is described as a homogeneous involvement of extensive areas of parenchyma but, if the descriptions of the pathology are studied carefully, a suggestion of nodulation is found to exist in these areas. As Swan has pointed out, this nodulation is the usual finding, especially at the periphery of the regions. It may in many cases be masked by changes due to secondary infection, but it seems to be the typical underlying pathological process. Necrosis is almost always absent, but may be found in scattered regions associated with the secondary infection. With this in mind, we shall analyze the roentgenograms of our own cases and add some observations from the cases in the literature.

TABLE II: SITES OF METASTASES IN 76 CASES OF PULMONARY ADENOMATOSIS

Hilar and mediastinal nodes	29
Liver	14
Bone	6
Adrenal	8
Brain	5
Kidney	5
Pericardium	4
Retroperitoneal nodes	5
Spleen	2
Urinary bladder	1
Cervical nodes	2
Diaphragm	2
Peritoneum	1
Pancreas	1
Stomach	1
Thyroid	1

If we review the previously reported cases, we find that approximately one half are described as nodular and the other half as of the diffuse type (Table I). A close study of the roentgenograms (see Fig. 4) shows that the margins of the nodules are not sharp or well circumscribed; their edges are hazy due to an invasion of the surrounding tissue by the neoplastic process coupled with inflammatory changes. There is a tendency for the nodules, where they lie in close proximity, to coalesce, but in the areas where the process is diffuse and homogeneous the margins still preserve the original nodularity to varying degrees. Over-penetrated roentgenograms may be necessary to show this. The diffuse areas seem to be the result, then, of a coalescence of the nodules, together with added components of secondary inflammation and atelectasis. The latter two factors may play a greater or lesser part in producing the roentgenographic picture, depending on their extensiveness. Swan, too, arrived at this conclusion on the basis of his review of cases. We wish to emphasize it again in an attempt to show that the basic radiological pattern does not differ. It is the same process, simply with the coa-

lescence of the nodules carried to the extreme in some areas in some cases.

In regard to the malignancy of these lesions, in our minds there is little doubt. In the same lesion one may find all transitions from the simple lining of the alveolar walls with a single layer of cuboidal or cylindrical cells to a profuse papillary proliferation coupled with invasion of the perivascular and pleural lymphatic channels and occasional lymphatic emboli. Still stronger evidence is the presence of distant metastases which occur in some 50 per cent of the reported cases (Table I). Common sites (Table II) include regional nodes, brain, abdominal organs, and bone. The histologic appearance of the metastases simulates that of adenocarcinoma, necrosis usually being absent and the cells closely resembling those found investing the alveoli. The lesion is always fatal.

DIFFERENTIAL DIAGNOSIS

Swan points out that the gross pathologic appearance may be confused with a chronic granulomatous condition such as tuberculosis, histoplasmosis, coccidioidosis, sarcoid, leukemia, Hodgkin's disease, secondary neoplasm, etc.

Tuberculosis: The absence of tubercle bacilli, in the presence of the usual widespread roentgenographic findings, should lead one to suspect neoplastic disease. The tuberculin test may or may not be of aid, since the vast majority of these cases are in the age group where the test is positive.

Coccidioidosis: Here too, sputum tests may be of great aid in establishing the diagnosis. The coccidioidin test assumes considerable importance in the ruling out of this condition.

Histoplasmosis: The histoplasmin skin test is of aid here. Blood cultures may be positive for *Histoplasma capsulatum* in its yeast phase. Also, inoculation may be carried out on mice, with bronchial material.

Sarcoidosis: The absence of hilar or peritracheal lymphadenopathy points away from sarcoidosis. In pulmonary adenomatosis the nodules have a more general distribution than those usually seen in sarcoid patients. The general debility of the patient is also in general inconsistent with sarcoid.

Hodgkin's Disease: The absence of involvement of the hilar nodes, as well as nodes elsewhere, is suggestive in ruling out Hodgkin's disease. When node involvement does occur (Case 1), a biopsy settles the issue.

Leukemia: Lung infiltrations in leukemia are usually small and have the fine stippling of miliary tuberculosis rather than the nodular character of pulmonary adenomatosis. Blood studies will usually establish the diagnosis of leukemia.

Xanthomatosis: The pulmonary pattern in xanthomatosis shows fibrotic and emphysematous components which are not seen in pulmonary adenomatosis.

Rheumatic Pneumonitis and Loeffler's Pneumonia: Here the fleeting and transitory nature of the infiltration rules out pulmonary adenomatosis. Loeffler's pneumonia is, of course, usually accompanied by a peripheral eosinophilia.

Secondary Neoplasm: This constitutes the greatest problem of all. In some of the cases in the literature the distinction has not been made even at the autopsy table. Bronchial washings and sputum must be collected and submitted for microscopic examination, preferably with cell block. If effusion is present, studies of the pleural fluid must be made. In addition, exhaustive clinical and radiographic examinations must be carried out to exclude a primary tumor.

SUMMARY

Two cases of pulmonary adenomatosis are added to the 74 the author has been able to find in the literature.

Nodular and diffuse types of the disease are generally recognized, but actually the fundamental radiographic picture is always nodular, although the nodules may coalesce to form diffuse areas or be masked by atelectasis or pneumonitis. In these

instances nodulation will nearly always be evident at the periphery of the diffuse process.

It is felt that pulmonary adenomatosis should be considered malignant, since it is invariably fatal and since 50 per cent of the cases show distant metastases.

If the radiologist keeps the picture in mind and suggests the possibility, and the clinician carries out the examination with due diligence and the aid of a capable pathologist, more of these cases will be diagnosed before autopsy.

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SUMARIO

Adenomatosis Pulmonar (Tumores Alvéolocelulares)

A los 74 casos de adenomatosis pulmonar que pudo encontrar en la literatura, el A. agrega ahora 2 más. El cuadro radiográfico fundamental es siempre nodular, aunque los nódulos pueden coalescer para formar zonas difusas o ser enmascarados por atelectasia o neumonitis. En esos casos, se divisará casi siempre nodulación en la periferia del proceso difuso.

Parece que la adenomatosis pulmonar debe ser considerada maligna, dado que resulta letal invariablemente y que 50 por ciento de los casos muestran metástasis remotas.

Si el radiólogo tiene el cuadro presente y sugiere la posibilidad, y el clínico lleva a cabo el examen con la diligencia debida y la ayuda de un patólogo competente, se diagnosticarán más de estos casos antes de la autopsia.

Osteogenesis Imperfecta[1]

DOUGLAS D. GAIN, M.D., and DONALD E. LAWSON, M. D.

OSTEOGENESIS imperfecta or fragilitas ossium has been described since the 18th century. It was given its present name of osteogenesis imperfecta by Vrolik in 1849. This is a disease which involves the tissues developing from the primitive mesenchyme. The characteristic feature is brittleness of the bones, with varying numbers of fractures, often following slight trauma. The condition is seen at all ages, chiefly in the infant, and often *in utero*. Various types have been recognized by different observers. The most common are the *non-hereditary congenital type*, which appears *in utero* or at birth, and the *hereditary type*. In the non-hereditary type the sclerae may be blue or white, and characteristic roentgen changes are present in either event. The hereditary type may also be associated with either blue or white (rare) sclerae with a characteristic roentgen picture, or with blue sclerae and atypical roentgen findings. The cases have been classified also according to the age at which the disease is recognized, that is, fetal cases, infantile cases, adolescent cases, and late cases.

PATHOLOGY

The underlying pathological process appears to be deficient osteogenesis; in the more severe congenital forms there is some resemblance to the changes found in infantile scurvy. The most marked deformities are in the long bones. These are slender, the cortex is thin, and the trabeculae are rudimentary. The periosteum is thin, while marrow spaces are enlarged. Fractures are often subperiosteal, without displacement, and callus formation follows promptly. On section, the shafts are soft. The epiphyses may be relatively normal until late in the disease, when degenerative changes may appear. Microscopic sections reveal complete loss of the normal bony structure, with the haversian canals appearing as wide spaces interspersed with embryonal and osteoid tissue. The bony lamellae are lacking. Fibroblasts, chondroblasts, and transitional cells replace osteoblasts. Sections taken through an area of callus may reveal cartilaginous tissue with extensive areas of necrosis. In the diaphyseal portion of the bone necrotic areas are seen.

ROENTGEN FINDINGS

Skull: The visible bone appears to be made up of isolated islands. Early in the course of the disease the suture lines are difficult to delineate; later they are marked by the development of wormian bones, especially in the lambdoid and coronal sutures. Increase in the bitemporal diameter of the skull is common. It is almost impossible, however, to differentiate the skull changes in osteogenesis imperfecta from those of cleidocranial dysostosis.

Long Bones: The characteristic findings in the long bones are a thin cortex and a large medullary cavity. Osteoporosis may be more severe in the lower extremities than in the upper. At a later age some of this may be due to atrophy of disuse. Many of the epiphyses present a foamy appearance. Bowing and angulation of the shafts of the long bones are the rule, due in part to malunion of true fractures.

Spine: Softening of the vertebral bodies is seen, with flattening and wedging and associated ballooning of the intervertebral disks.

ASSOCIATED CHANGES

Blue sclerae are reported in many cases. In one series all patients with the heredi-

[1] From the Department of Radiology, Memorial Hospital (formerly St. Monica's), Phoenix, Ariz. Accepted for publication in June 1951.

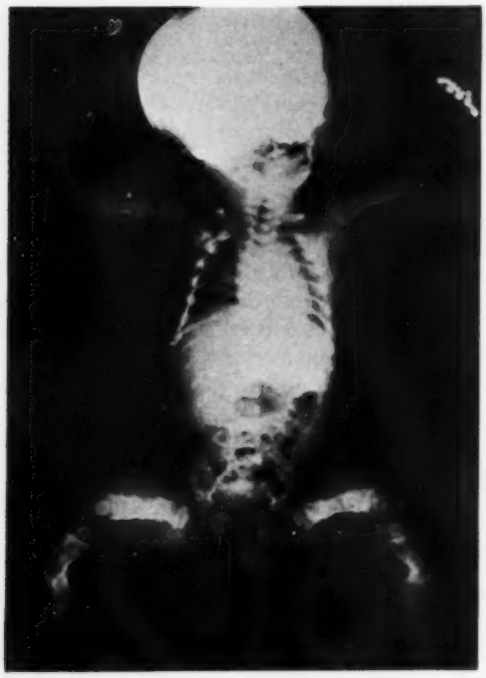

Fig. 1. Film obtained three days after birth, showing multiple fractures.

Fig. 2. Film obtained at sixteen days of age, showing callus formation.

tary form were said to have blue sclerae, 65 per cent had brittle bones with multiple fractures, and in 43 per cent otosclerosis developed, with progressive deafness. There was also noted a marked decrease in the number of fractures with the onset of puberty. In a study of five generations by one group of investigators it was shown that no generation was skipped. The disease is inherited as a dominant mendelian factor. Sexes are equally affected. There is a great variation in the intensity of the manifestations, usually in inverse ratio to the patient's age at onset. Thus, in the newborn it is sometimes fatal, while in the adult it may be recognized only incidentally, on examination for some other condition. Blood chemistry fails to reveal a constant or consistent change. Calcium and phosphorus levels are usually normal. Alkaline phosphatase has been found to be increased in only 30 per cent of the patients. In many series of cases studied, there appeared to be a tendency towards a slight anemia, with a count of about four million red cells. An occasional patient showed traces of albumin in the urine.

TREATMENT

There has not as yet been discovered a successful form of treatment for osteogenesis imperfecta. Thymus extract has been used with questionable results. Other investigators have tried anterior pituitary extract and some have reported favorable results. Treatment generally is limited to supportive measures, with adequate orthopedic care, high vitamin intake, etc.

CASE PRESENTATION

In 7,951 deliveries from February 1944 to June 1951 at Memorial Hospital (Phoenix) only one case of congenital osteogenesis imperfecta was found. Available literature gave no figures as to the frequency of the disease, merely describing it as rare.

M. F., female, was born on April 14, 1951. The mother was of Mexican descent, the father white. No family history of osteogenesis imperfecta was obtained. The mother was twenty years of age, with the usual history of measles and mumps, but no other diseases. Serologic tests were negative. An earlier pregnancy had ended in spontaneous abortion at approximately two months. The present pregnancy, the second, was normal with no complications in evidence until the time of delivery. Forceps were not used. Immediately after the birth of the child it was noted that the extremities were shortened, with obvious fractures of the legs and arms. Blue sclerae were not present. The birth weight was 5 pounds, 10 ounces, and in one week the infant had gained 8 ounces. It took its feedings well but cried when it was touched or moved. A film to include the entire body was made on April 17 (Fig. 1), showing fractures involving the radius and ulna, humerus, femur, tibia, fibula and ribs. The bones of the skull were parchment-like, with wide dehiscence, consistent with defective membranous bone development.

On April 22, respirations became shallow and rapid, and the temperature rose to 104° F. (rectal). The patient was placed on penicillin therapy, 50,000 units intramuscularly every four hours. On April 24 the red cell count was 6,600,000; white cell count 20,600 with eosinophils 1, lymphocytes 50, stab forms 3, segmented cells 4, and monocytes 2; hemoglobin 16.8 gm. (108 per cent).

A progress film obtained on April 30 (Fig. 2) showed increased density in the entire left lung field indicative of pneumonia and some degree of atelectasis. Callus formation was visible, consistent with healing of fractures.

On April 28 a blood count showed 3,090,000 red cells and 22,000 white cells. Urinalysis, on April 25, was not remarkable except for albumin 1+ and 5 to 30 white blood cells per high-power field.

The infant is still alive and taking its feedings fairly well.

SUMMARY

A case of osteogenesis of the non-hereditary congenital type is reported. This was the only instance of congenital osteogenesis imperfecta seen among 7,957 deliveries, including stillbirths.

The extremities were shortened and multiple fractures were present involving the radius, ulna, humerus, femur, tibia, fibula, and ribs. The bones of the skull were parchment-like, with wide dehiscence, consistent with defective membranous bone development. Sixteen days after birth, roentgenograms showed evidence of callus formation.

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SUMARIO

Osteogénesis Imperfecta

El caso comunicado es de osteogenia imperfecta de forma congénita no hereditaria en un recién nacido, siendo el único congénito de ese género encontrado en 7,957 partos, incluso mortinatos, en el hospital en que fué observado. Los miembros estaban acortados y había fracturas múltiples que afectaban el radio, cúbito, húmero, fémur, tibia, peroné y costillas. Los huesos del cráneo estaban apergaminados, con mucha dehiscencia, correspondiendo a defectuosa osteogenia membranosa. A los dieciséis días del nacimiento, las radiografías revelaron signos de formación de callo.

The Anomalous Hyoid

Review of the Literature and Report of a Case[1]

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ALTHOUGH the roentgen ray affords the most informative single means of study of the hyoid apparatus, only two case reports were found in the radiologic literature concerning its anomalies (1, 3), both calling attention to anomalous ossification in the stylohyoid ligaments, with no mention of anomaly of the hyoid bone itself. Such reports as have appeared in the general medical literature deal almost entirely with anomalous long styloid processes and ossified stylohyoid ligaments, though Puchowski (4) reported a case in which there was anomalous ossification in the hyothyroid ligaments as well.

Anomalous long styloid processes are said to be encountered in one of every 3,000 tonsillectomies (2). Forty-four cases of complete ossification of the stylohyoid ligaments have been reported. In the case to be recorded here, an anomalous hyoid bone was associated with elongated styloid processes and ossifications in the stylohyoid and hyothyroid ligaments. A search of the literature disclosed no similar example.

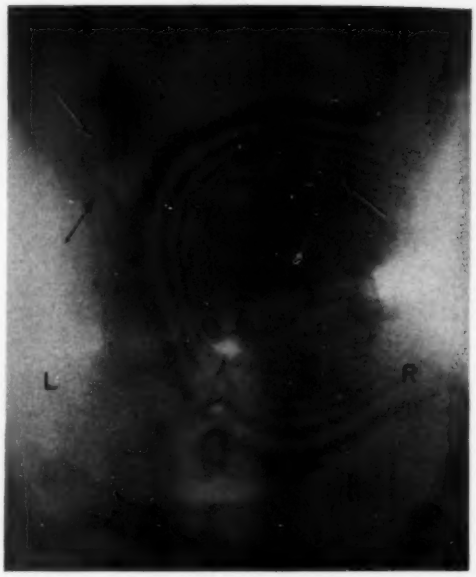

Fig. 1. Anteroposterior view of the hyoid apparatus. On the left the anomalous greater cornu of the hyoid and the superior cornu of the thyroid cartilage, appear lateral to the vertebrae (indicated by arrows) and could be readily confused with anomalous vertebral processes, ectopic bones or osteoarthritic deposits. On the right the enlarged greater cornu of the hyoid and the superior cornu of the thyroid cartilage are seen in tangential view overlying the transverse processes.

REPORT OF CASE

A white male, 39 years of age, had suffered for the past twenty-five years from attacks of pain in the right side of the neck radiating to the external occipital protuberance. The attacks, lasting one or two days, occurred at intervals of three to six months. They were initiated by resting on the right side of the neck or by a sudden twist of the head to the right. Associated with the pain were moderate dysphagia and tenderness internally in the lateral pharyngeal wall and externally over the right half of the hyoid apparatus.

Roentgen study showed the body of the hyoid bone to be about 50 per cent larger than usual (Fig. 2). The combined length of the styloid process and ossified stylohyoid ligament was 6.5 cm. bilaterally. The right greater cornu of the hyoid bone stood 1.5 cm. higher in the neck than the greater cornu on the left (Fig. 3) and consisted of a horizontal segment (0.6 × 4.0 cm.) and a vertical segment (1 × 3 cm.) inseparably fused into a 7-shaped bone. The vertical segment formed a conspicuous joint with a bone (1 × 1 cm.) replacing the right superior cornu of the thyroid cartilage. The distal centimeter of the left greater cornu of the hyoid bone (0.4 × 4.0 cm.) was angulated 40° downward, backward, and outward and approached to within 0.2 cm. of the backward, upward, and outward angulated superior cornu (0.4 × 1.5 cm.) of the thyroid cartilage (Figs. 1 and 2).

COMMENT

In man the hyoid bone is the only bone which normally forms no joint with other bones. It has a considerable range of up-

[1] Accepted for publication in June 1951.

ward, downward, backward, and forward mobility. When, however, the stylohyoid and/or hyothyroid ligaments are partially or completely ossified, the mobility of the hyoid bone is interfered with and the hyoid apparatus becomes less flexible, so that exceptional stresses may produce symptoms.

In the case reported here, the styloid processes measured 3 cm. longer than normal. The ossifications in the stylohyoid ligaments (ceratohyoids) were distinct bones, measuring 1 cm. in length and forming definite joints with the elongated styloid processes. These followed the normal course in the neck and produced disturbing symptoms only when exceptional stresses were applied.

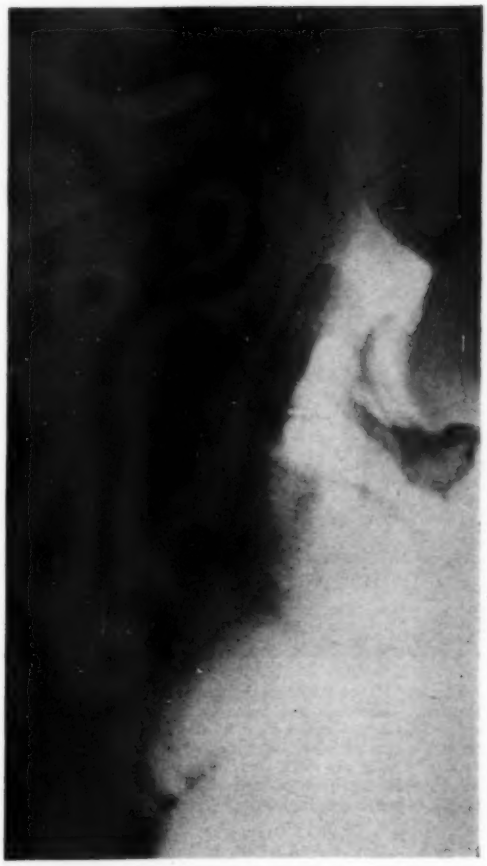

Fig. 2. Right lateral view of the hyoid apparatus. Note the large size of the body of the hyoid and the right greater cornu. A ceratohyoid is visible beneath the angle of the mandible (arrow).

SYMPTOMS

It is not always recognized that anomalies of the hyoid apparatus may cause paresthesias in the neck or throat, with a sense of fullness, burning, pressure, or foreign body; pains in the ears, neck, throat, tonsils, and back of the tongue, which may radiate to the external occipital protuberance; persistent cough or paroxysms of coughing; dysphagia; dysphonia and dysmasesis. In cases of penetration or perforation of the processes these symptoms may last for weeks or months. In the absence of penetration or perforation the duration is but a few days.

DIAGNOSIS

Inspection of the throat may reveal the long processes protruding from the tonsil, lateral pharyngeal wall, or base of the tongue. If the process is not visible, palpation over these areas may disclose a bony resistance and be attended by pain radiating to the ear or external occipital protuberance. In the case recorded, palpation externally over the abnormal hyoid on the right side produced pain radiating to the external occipital protuberance. External palpation over the completely ossified stylohyoid ligaments may produce similar radiating pain.

Roentgenography and fluoroscopy afford the most important means of study of the hyoid apparatus and should be done in all cases of unexplained dysphagia. The abnormal hyoid apparatus in the present instance was first detected during a barium meal fluoroscopic examination.

CLINICAL COURSE

A conspicuous feature of the symptom-producing anomalous hyoid is the long clinical course, usually extending over years, with alternating symptomatic and asymptomatic periods. In cases with penetrating or perforating processes, a tonsillitis or pharyngitis usually precedes

Fig. 3. Right anterior oblique view of the hyoid apparatus. The enlarged 7-shaped greater cornu of the hyoid stands 1.5 cm. higher in the neck than the left. Note the conspicuous joint formed by the vertical segment of the hyoid with the enlarged superior cornu of the thyroid cartilage on the right. Ceratohyoids are visible beneath the angles of the mandible (arrows).

the onset of symptoms, which continue until the infection is cleared. In cases with anomalous long styloid processes or partially or completely ossified stylohyoid ligaments pursuing a normal course in the neck, symptoms follow from unusual stresses, such as a sudden twist of the head or pressure during recumbency.

DIFFERENTIAL DIAGNOSIS

No confusion with tonsillitis, pharyngitis, tumor, esophageal diverticulum, or foreign body should occur if the characteristic symptoms, signs, clinical course, and radiographic appearances of the anomalous hyoid are kept in mind. These cases, however, usually undergo frequent examination and unsuccessful treatment before the actual nature of the condition is appreciated.

TREATMENT

When symptoms are produced by an anomalous hyoid apparatus with penetrating or perforating ossifications, the proper treatment is surgical removal of the offending ossifications. This procedure is simple and effective. For the anomalous hyoid without penetrating or perforating ossifications, the avoidance of stresses leading to symptoms is all that is required. This latter course proved satisfactory in the case described.

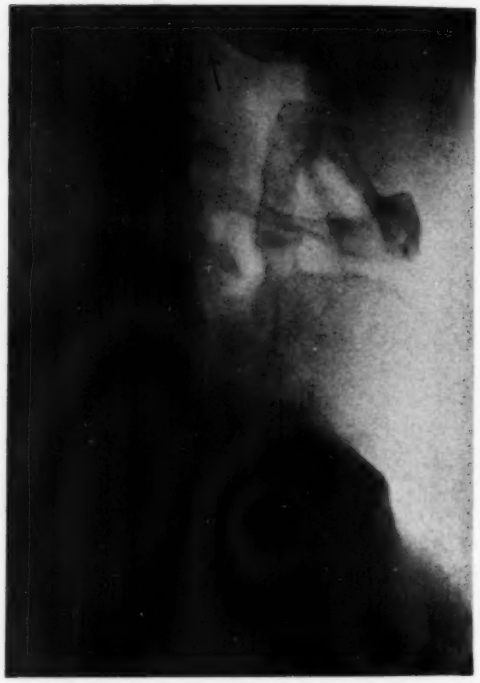

Fig. 4. Left anterior oblique view of the hyoid apparatus. The enlarged left greater cornu of the hyoid is seen as it courses abnormally backward and outward beneath the right. The large vertical segment of the right greater cornu of the hyoid and the large right superior cornu of the thyroid cartilage are well outlined. A ceratohyoid is visible beneath the angle of the mandible (arrow).

SUMMARY

The literature on anomalies of the hyoid apparatus is briefly reviewed and a case is reported in which an anomalous hyoid bone was associated with elongated styloid

processes and ossifications in the stylohyoid and hyothyroid ligaments.

Partial or complete ossification of the stylohyoid or hyothyroid ligaments interferes with the mobility of the hyoid bone and leads to symptoms—pain, dysphagia, and tenderness—upon the application of unusual stresses, as on a sudden twist of the head. When the ossified ligaments pursue an abnormal course in the neck, symptoms may be due to penetration or perforation. Radiologic study of the hyoid apparatus is indicated in the presence of unexplained dysphagia.

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SUMARIO

El Hioides Anómalo. Repaso de la Literatura y Presentación de un Caso

Un breve repaso de la literatura relativa a las anomalías del aparato hioideo va seguido de la descripción de un caso en el que un hioides anómalo estaba unido a alargamiento de las apófisis estiloideas y osificaciones de los ligamentos estilohioideo e hiotiroideos.

La osificación parcial o total de los ligamentos estilohioideo o hiotiroideos afecta la movilidad del hioides y ocasiona síntomas—dolor, disfagia e hiperestesia—al aplicarse presiones inusitadas, como sucede al torcer de pronto la cabeza. Cuando los ligamentos osificados prosiguen una evolución anómala en el cuello, los síntomas pueden muy bien ser efecto de la penetración o perforación.

El estudio radiológico del aparato hioideo se halla indicado en presencia de toda disfagia inexplicada.

Acute Pneumocholecystitis

Case Report and Brief Review of the Literature[1]

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A REVIEW OF THE literature revealed only 18 cases of pneumocholecystitis. To these the following case is added.

A. D., a 45-year-old colored female, was admitted to the hospital Jan. 20, 1951, acutely ill. Three days earlier, after her evening meal, she had experienced cramp-like abdominal pain followed by vomiting. The pain soon became localized to the right upper quadrant, slowly radiating to the right lower quadrant. Vomiting occurred at intervals. The bowels had not moved in the past two days.

There was no history of previous attacks of this nature. The patient had had the usual childhood diseases. She had undergone an appendectomy in 1934, a total hysterectomy in 1935, a tonsillectomy in 1939, a subtotal thyroidectomy and excision of a cervical polyp in 1947. The family history was noncontributory.

Physical examination showed abdominal distention with generalized tenderness more marked on the right, with muscle guarding. The temperature was subnormal. The clinical impression was acute cholecystitis.

The blood count on the first three hospital days was as follows:

	First Day	Second Day	Third Day
Red cells	4,100,000	5,000,000	4,700,000
Hemoglobin	80%	14.5 gm.	13.5 gm.
White cells	12,000	18,000	9,500
Basophils	4	9	5
Polymorphonucleocytes	74	79	57
Lymphocytes	16	10	35
Eosinophils	2	2	3
Monocytes	2	0	0

Other laboratory findings were normal.

The patient ran a low-grade fever throughout the period of hospitalization, with one rise to 103° (R). Improvement was obtained on a regime of intravenous fluids, antibiotics, sedation, antispasmodics, and other supportive measures, and the patient was discharged about the fifteenth day, to return in six weeks for operation.

Unfortunately x-ray examination was not ordered until eight days after admission. After this, films were obtained daily until discharge. On the initial roentgenograms a dilated pear-shaped gallbladder was demonstrable, containing gas or air, with pericholecystic air infiltration. The biliary duct system could not be identified at any time. A gastrointestinal series was negative. No fistulous tract could be demonstrated. Examination by the Graham method showed a pathological non-filling gallbladder.

Duodenal drainage was instituted on the fourth day, the Miller-Abbott tube being placed in position under fluoroscopic control. Fractional specimens were collected and cultured, showing non-hemolytic streptococcus, E. coli, a yeast-like fungus (contaminant?), and a Gram-positive rod.

After the tenth day there was a diminution in the size of the gallbladder, which progressed rapidly. On the fifteenth day all the gas had been absorbed.

The patient was readmitted for operation on March 12. Except for slight tenderness in the right upper quadrant, there were no significant findings. At operation the gallbladder was found to be subacutely inflamed, imbedded in massive adhesions, and removable with difficulty. Cultures of the contents revealed hemolytic staphylococci.

Though the patient was moderately ill for about a week, the postoperative course was more favorable than had been expected.

The gallbladder was dilated and the serosa inflamed. At the extreme end of the fundus was a perforation 1.0 cm. in diameter. The mucosa was redundant, green, and edematous (appearing to stand up in bubbles as if under pressure by gas). The wall was thickened, measuring 0.5 cm. About 100 tiny green morulated stones were present in the lumen. Microscopically the picture was that of an acute and chronic cholecystitis and cholelithiasis.

COMMENT

In 1948, Heifetz and Senturia (1) reviewed the literature of the past forty-five years and discovered only 8 true cases of pneumocholecystitis. To these they added 2 cases. Another example was reported by Culver and Kline (2) in the same year. Cases have since been added by Jemerin (3), Friedman, Aurelius, and Rigler (4), Elsey and Hudson (5), and Qvist (6).

It is a striking observation that of the 19 cases of pneumocholecystitis, only 5 have occurred in females; 17 patients have been

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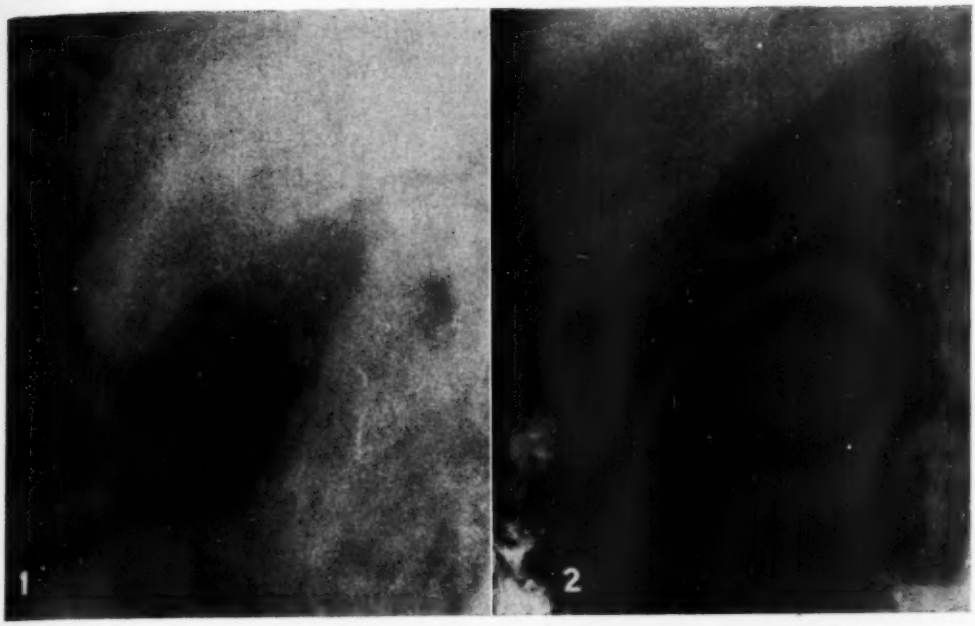

Fig. 1. Film obtained eight days after admission, showing gas-filled gallbladder and pericholecystic gas infiltration.

Fig. 2. Diminution in size of gallbladder on the tenth day after admission. Pericholecystic gas, believed to be in Aschoff-Rokitansky sinuses, still demonstrable.

over forty years old; 1 was thirty-two and 1 thirty-eight.

Of the 13 patients operated upon, including ours, 3 died. In 2 of these, examination revealed *Clostridium welchii* or *perfringens*. In all but one of the operated cases, stones were present, ranging from a single large calculus to many small ones.

All patients had symptoms and signs typical of acute cholecystitis. It is agreed, however, that the diagnosis of acute gaseous cholecystitis can be made only on roentgen examination.

An unusual feature of many of the cases was pericholecystic infiltration of gas. It is our impression, after reviewing the article by March (7), that this infiltration is due to gas in the Aschoff-Rokitansky sinuses. This is easily conceivable if one reviews the histology as given in Maximow and Bloom's *Textbook of Histology*. This describes the sinuses as small diverticula or peculiar outpouchings in the mucosa, lined with and continuous with the surface epithelium. These outpouchings

Fig. 3. Film obtained on the fifteenth day. All evidence of gas in the gallbladder has disappeared.

extend through the lamina propria and into the muscular layer. The presence of Aschoff-Rokitansky sinuses indicates pathological changes. There is no evidence to show an embryological origin.

We were unable to demonstrate a fistulous tract between the gastro-intestinal tract and biliary tract. The roentgenograms, moreover, completely satisfied the criteria set down by McCorkle and Fong (8) for pneumocholecystitis, namely:

(1) Gas confined to the lumen.
(2) No fluid level on upright films.
(3) No visualization of duct system.
(4) Gas present in gallbladder wall.

In the presence of a communication, the cystic ducts, hepatic ducts, and common ducts are seen. The gallbladder is contracted or not seen at all. The communication may be demonstrated by means of barium studies.

Acute cholecystitis (9) is usually a nonspecific inflammatory process caused by streptococci, staphylococci, E. coli, and rarely by *Eberthella*. Kolmer (10) includes, also, the *Clostridium* group. He states that, although infection may be of importance in the etiology of cholecystitis and cholangitis, mechanical, vascular, toxic, and chemical factors are apparently the predisposing causes, with infection playing a secondary role.

It is the general consensus of opinion that in the majority of cases of acute cholecystitis there is obstruction in the neck of the gallbladder by stones. Other mechanical causes of obstruction are strictures, kinks, anomalous vessels, adhesions, etc. Biliary stasis resulting in inflammatory changes in the wall may act as a focus for the invasion and infection by organisms carried by the lymphatics and blood stream (11).

SUMMARY

A case of pneumocholecystitis is presented with a brief review of the literature and discussion of the reported cases.

It is our impression that the pericholecystic infiltration of gas seen in this case, and others in the literature, represents gas in the Aschoff-Rokitansky sinuses. This is indicative of a chronic pathological process.

The importance of early scout films in any cases of suspected cholecystitis is of value for recognition of this condition.

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SUMARIO

Neumocolecistitis Aguda: Historia Clínica y Breve Repaso de la Literatura

Comunícase un caso de neumocolecistitis aguda en una mujer. Los síntomas eran de colecistitis aguda. La radiografía reveló una vesícula biliar piriforme y dilatada que contenía gas, con infiltración pericolecística por gas. Esto último parece ser típico y pasa por representar gas presente en los senos de Aschoff-Rokitansky, que son, en sí mismos, indicativos de un estado patológico crónico.

Clinical Experience with Telepaque, A New Gallbladder Compound[1]

RUSSELL H. MORGAN, M.D., and HAL B. STEWART, M.D.

DURING THE PAST few years, a number of new compounds have been developed for the radiographic visualization of the gallbladder. By and large, these materials have been designed not only to provide greater opacification of that organ than their predecessors but also to reduce the number and severity of the clinical reactions which frequently follow the administration of gallbladder dyes. Some of these compounds, such as iodoalphionic acid (priodax), have proved quite satisfactory and are now widely used throughout this country.

Recently, a new gallbladder compound has been developed[2] and has been made available in limited quantities for experimental purposes. This material, to be marketed under the name of telepaque, contains approximately 67 per cent iodine by weight. Like iodoalphionic acid, it has been prepared for oral administration. The currently recommended dose has been established at a level of 3 gm.

CLINICAL STUDY

In preliminary trials at the Johns Hopkins Hospital, telepaque produced sufficiently better results than those obtained with other gallbladder media that an investigation was undertaken to evaluate the characteristics of the compound on a quantitative basis. In this study, telepaque (3 gm.) and iodoalphionic acid (3 gm.) were administered alternately to 200 more or less consecutive patients who were referred to the Department of Radiology for gallbladder examination; that is, 100 patients received one compound and 100 patients the other. The group who received iodoalphionic acid served as a standard of reference in the evaluation of the newer drug. In each of the 200 patients, the gallbladder medium was administered after a light fat-free dinner during the evening preceding the day of the examination. The films were obtained during the morning hours, approximately fifteen hours after the administration of the compound.

TABLE I: AGE AND SEX DISTRIBUTIONS OF PATIENTS RECEIVING TELEPAQUE AND IODOALPHIONIC ACID

	—Telepaque—		Iodoalphionic —Acid—	
Age Group	Male	Female	Male	Female
15–29	1	2	3	8
30–39	7	18	6	14
40–49	16	16	8	18
50–59	9	19	9	19
60–69	6	5	5	7
70 and over	1	0	1	2

The patients who received telepaque were similar in most respects to those who received iodoalphionic acid. The age and sex distributions, as set forth in Table I, show no great differences. In both instances, females predominated over males and the age groups of forty to fifty-nine years had the greatest representation. Forty-five of the patients who received telepaque had had previous episodes of gallbladder colic; 43 of those taking iodoalphionic acid gave a similar history. Of the patients who received telepaque, 69 complained of eructation; 68 of the patients taking iodoalphionic acid presented this complaint. Fat intolerance was experienced by 67 of the patients who received telepaque; of the patients taking iodoalphionic acid, however, only 48 had this experience. In view of these data, it is evident that the individuals who took telepaque presented characteristics which were closely similar to those of the patients who received iodoalphionic acid

[1] From the Department of Radiology, the Johns Hopkins Medical Institutions. Accepted for publication in July 1951.

[2] By the Winthrop-Stearns Co.

The gallbladder examinations were analyzed from two points of view: a quantitative evaluation of the clarity of gallbladder visualization obtained with each of the gallbladder compounds and an evaluation of the clinical reactions to the media, including nausea, vomiting, diarrhea, and headaches.

The clarity of gallbladder visualization was measured by densitometric methods. As a part of each gallbladder study, an 8 × 10-inch radiographic film was made with the patient in the recumbent position and with a radiographic cone which limited the field of examination to a circular area approximately 8 inches in diameter. This film was placed upon a view box and the region of the gallbladder at which maximum contrast occurred with the surrounding field was observed. Two densitometric measurements were then made on the film with an Ansco-Sweet densitometer: one just inside the gallbladder shadow at the boundary of maximum contrast, the other just outside of the gallbladder shadow in the same region. The difference between the two measurements was then calculated. This difference is a quantitative measure of the contrast existing between the gallbladder and its surrounding field. Since, in studies of the gallbladder, contrast is the principal factor which controls image clarity, the densitometric measurements provided a reliable quantitative index of the clarity of visualization.

Under conventional radiographic conditions, the contrast of the gallbladder shadow is governed by a number of factors. In addition to the characteristics of the medium itself, the thickness of the patient, the efficiency of the radiographic grid, the kilovoltage applied to the x-ray tube, the radiographic exposure, and the processing of the film affect visualization. In the evaluation of the characteristics of a gallbladder medium, therefore, it is important that these factors be controlled as well as possible.

In this investigation, identical radiographic equipment was used for all of the 200 patients. The processing of films also was maintained under strict time-temperature control. Although considerable variation existed in the thicknesses of the various patients and in the kilovoltages employed on the x-ray tube in their examination, the average thickness of the patients who received telepaque (21.5 cm.) was closely similar to that of the patients who received iodoalphionic acid (21.6 cm.). Also, the average kilovoltage used in the examination of the patients who received telepaque (68 kv.p.) was closely similar to that of the patients who received iodoalphionic acid (69 kv.p.). As far as the control of radiographic exposure is concerned, inconsistencies become important only when the density of the processed radiographic film drops to a level less than 0.25. In our studies, some of the films did present densities lower than this value, but these were excluded from analysis.

CLINICAL RESULTS

Among the 100 individuals who received telepaque, there was visualization of the gallbladder in 93. In 82 satisfactory visualization was obtained with the first dose of the compound; in 11 instances a second dose of double strength was required. Eighty films were suitable for densitometric study; that is, the gallbladder shadow had a density of 0.25 or greater. In these films the average maximum contrast of the gallbladder shadow was 0.51 density unit, with a standard deviation of ±0.24 unit.

Among the patients who received iodoalphionic acid, there were 89 whose gallbladders concentrated the dye satisfactorily and 11 in whom the gallbladder was not visualized. In 70 a single dose of the gallbladder compound was sufficient for visualization; 19 required a second dose of double strength. Eighty films in this group, also, were suitable for densitometric study, the gallbladder shadows having a density of 0.25 or greater. The average maximum contrast of the gallbladder shadows was 0.38, with a standard deviation of ±0.19.

It will be observed that telepaque pro-

duced approximately 35 per cent greater opacification of the gallbladder than iodoalphionic acid. This, we believe, constitutes an improvement of considerable significance. It will also be noted that 40 per cent fewer patients required a second dose of the opaque medium for satisfactory visualization of the gallbladder in the telepaque series than in the iodoalphionic acid group. This, too, represents a real advantage in terms of patient and physician convenience for the new medium.

Data pertaining to the clinical reactions to the two gallbladder compounds were obtained on each of the 200 individuals studied. The patients were questioned concerning the occurrence of nausea, vomiting, diarrhea, and headache following the ingestion of the medium. Of the patients who received telepaque, 11 complained of slight nausea; 11 more were moderately distressed. The remaining 88 patients experienced no symptoms of this kind. There was no instance of vomiting. Of the patients who received iodoalphionic acid, 7 experienced slight nausea and 16 were moderately distressed. In 4 others, the nausea was sufficiently severe to produce emesis. Seventy-three individuals stated that they had no symptoms. The foregoing data are detailed in Table II.

TABLE II: NUMBER OF PATIENTS EXPERIENCING NAUSEA WITH TELEPAQUE AND IODOALPHIONIC ACID

Drug	Slight Nausea	Moderate Nausea	Severe Nausea With Emesis	Total
Telepaque	11	11	0	22
Iodoalphionic acid	7	16	4	27

From them, it is clearly evident that the distress of nausea was considerably less in the patients who received telepaque than in those who received iodoalphionic acid. Indeed, one patient who had had many previous gallbladder studies with a variety of compounds stated that telepaque was the first material which produced no distressing symptoms.

Diarrhea was also less severe in the telepaque series than in the iodoalphionic acid group. Forty patients who received telepaque experienced one to four episodes of diarrhea during the hours following administration of the drug, whereas 55 patients who took iodoalphionic acid reported one to six loose bowel movements.

Only a few of the patients complained of headache following the ingestion of either compound—6 receiving telepaque and 6 receiving iodoalphionic acid. There was one instance of dizziness and one instance of painful urination in each of the groups studied.

The data presented in the foregoing paragraphs appear to indicate that telepaque constitutes an excellent gallbladder medium. In our experience, iodoalphionic acid has been one of the most satisfactory gallbladder compounds which have been available to us. Telepaque, however, seems to be distinctly superior not only in its opacification but also in the diminished clinical reactions which follow its administration.

SUMMARY

In a quantitative investigation of the characteristics of a new gallbladder compound, telepaque, the clarity of gallbladder visualization was found to be approximately 35 per cent greater than that obtained with iodoalphionic acid. In addition, approximately 40 per cent fewer individuals required a double dose of telepaque for satisfactory visualization of the gallbladder than was the case with iodoalphionic acid. Finally, telepaque was found to be extremely mild from the standpoint of the clinical reactions following its administration. Among 100 patients who received the compound, none experienced emesis, only a few complained of nausea (mostly of a very slight nature), and the great majority had no symptoms of any kind.

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(*Para el sumario en español, véase la página siguiente.*)

SUMARIO

Observaciones Clínicas con el "Telepaco," Nuevo Compuesto para la Vesícula Biliar

En una investigación cuantitativa de las características de un nuevo compuesto, "telepaque" dedicado a empleo en la vesícula biliar, la claridad de la visualización colecística resultó ser aproximadamente 35 por ciento mayor que la obtenida con el ácido yodoalfiónico. Además, aproximadamente 40 por ciento menos individuos requirieron con "telepaque" una dosis doble para visualización de la vesícula biliar, que con ácido yodoalfiónico. Por fin, "telepaque" se mostró sumamente inofensivo en lo tocante a reacciones clínicas consecutivas a su administración. De 100 enfermos que recibieron el compuesto, ninguno experimentó vómitos, pocos fueron los que se quejaron de náuseas, y la gran mayoría no manifestó síntomas de ningún género.

Lithopedion

Case Report and Survey[1]

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THE WORD LITHOPEDION is a descriptive term derived from the Greek *lithos*, meaning stone, and *paidion*, meaning child, to designate a fetus that has become stony or petrified. There are no classic clinical signs or symptoms which are of aid in the diagnosis. The majority of cases have been discovered at unrelated surgical procedures, during routine roentgenography of the abdomen, or at necropsy.

Küchenmeister's classic article (5), in 1881, remains the basis of our present classification. He noted that calcification may involve either the fetus, membranes, or placenta, or any combination of these structures. On this basis, he proposed the following classification:

1. Lithokelyphos (stone sheath or egg shell), in which the membranes alone are calcified and form a hard shell surrounding the fetus. The fetus may undergo slight change only, or may be completely skeletonized, but is not involved in the process of calcification.
2. Lithokelyphopedion (stone sheath child), in which both the membranes and the fetus are calcified.
3. True lithopedion (stone child), in which the fetus is infiltrated with calcium salts and calcification of the membranes is negligible.

Oden and Lee (10), in 1940, enumerated the following conditions necessary for the development of a lithopedion: (1) The pregnancy must be extra-uterine. (2) The fetus must survive in the abdomen for more than three months (otherwise it is absorbed). (3) The condition must escape medical notice. (4) The fetus must remain sterile. (5) The necessary conditions for the deposition of calcium must be present, *i.e.* minimal and sluggish circulation.

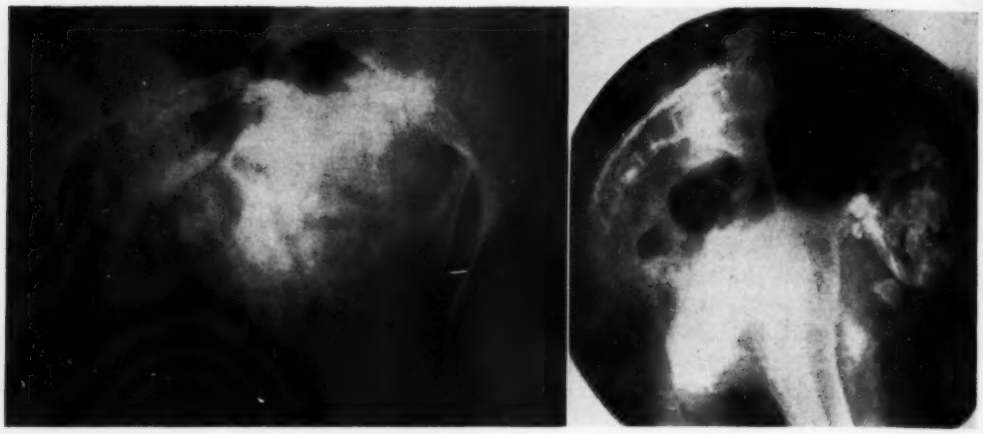
In reviewing the literature, one is impressed with the paucity of reports in the English language (impression of cases reported prior to 1925).

Schrenk, quoted by Schumann (13), in 1893 gave the incidence of lithopedion formation in ectopic pregnancy as 1.8 per cent, or 11 among 610 cases. Bainbridge (1) in 1912 estimated the incidence as 1.5 per cent, or 9 among 626 cases. In 1928 Masson and Simon (7) at the Mayo Clinic reported 9 cases in 445 extra-uterine pregnancies, or 2 per cent.

In 1939, Mathieu (8), adding 31 cases to those previously collected, reported a total of 229 cases in the literature. Of the 31 cases, 8 were discovered by roentgenography. Reeves and Lipman (11), in 1941, brought the grand total of previously reported cases to approximately 236, covering five centuries. At the time of their publication, 247 cases had been reported. Mathieu's summary shows the patients to range in age from thirty to one hundred years, with a period of retention from four to sixty years.

Mathieu also collected 274 recorded instances (up to 1936) of combined intra- and extra-uterine pregnancies, but was able to find among these only one case in which lithopedion developed. He added another example. Umnowa (16), in 1934, reported a case in which calcified masses were removed from either side of the abdomen. Roentgenograms showed that each mass contained a lithopedion. One was of two or three months development and eleven years duration; the other was of six months development and nine years duration. Varchavsky and Elenevskaya (17), in 1935, observed a bilateral tubal pregnancy with transformation into a litho-

[1] From the Department of Radiology, Kings County Hospital (Acting Director, Leo Harrington, M.D.) Brooklyn, N. Y. Accepted for publication in June 1951.



Figs. 1 and 2. Anteroposterior and lateral views showing the lithopedion.

pedion on one side and into a secondary abdominal pregnancy carried to term on the other side. In 1941, Mayer and Berson (9) reported an intra-uterine pregnancy followed by an extra-uterine pregnancy and the accidental finding of a lithopedion free in the abdominal cavity. However, no roentgenograms of this case were published. Sante and Emmert (12), in 1932, described an interesting and unusual case in which they demonstrated the contraction and calcification of the fetus. Excellent roentgenograms were published with this latter report. In a case presented by Tractenberg and Oliver (15) there was an acute episode resembling an intra-abdominal hemorrhage during the patient's third pregnancy. This was treated conservatively, and a lithopedion subsequently developed. Roentgenograms taken over a period of four years showing the development of the lithopedion are presented. There have been other recent reports (2, 3, 4, 6, 14).

The diagnosis of lithopedion is dependent on a careful clinical history, aided by the finding of a hard pelvic mass on physical examination and by roentgenography. Zurhille (quoted by Schumann) suggested that a metallic sound be carefully introduced into the uterine cavity before the roentgenogram is made, in order to establish the relation of the uterine cavity to the shadow of the fetal skeleton. If this is carefully done and a current intra-uterine pregnancy excluded, no harm can result to the patient. The present rarity of lithopedion is probably due to early diagnosis and surgical intervention in extra-uterine pregnancy.

CASE REPORT

S. H., a 69-year-old white married female, was admitted to Kings County Hospital, Long Island College Obstetrical and Gynecological Division,[1] on Feb. 23, 1951, complaining of vaginal bleeding of three days duration. She had had an uncomplicated menopause at the age of forty-two years and had been asymptomatic gynecologically until the present illness. The vaginal bleeding was spontaneous, sudden, and painless, and necessitated the use of one pad per day. There was a history of urgency and frequency of urination for the past six months. No melena or change in bowel habits had been noted.

The patient had been admitted to the same hospital in 1941 for evaluation of transient glycosuria. Pelvic examination during that admission was reported as normal. In 1942, there was a second admission for emergency treatment of a strangulated umbilical hernia, which was corrected, and from which the patient made an uneventful recovery. Unfortunately, no roentgenograms were taken during these earlier admissions.

In 1902 and 1904, the patient had had normal full-term spontaneous pregnancies with no complications. Menstruation had begun at twelve years of age, with regular periods every twenty-eight days, lasting three or four days. There was no history of ab-

[1] Dr. Louis Hellman, Director.

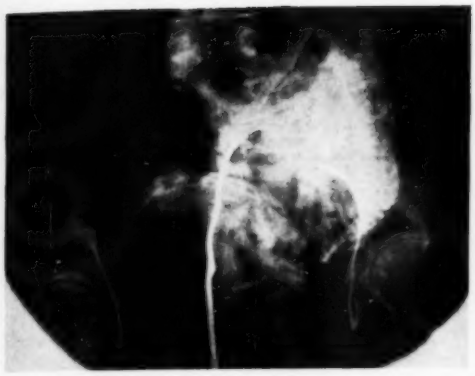


Fig. 3. Anteroposterior view of the pelvis with a cannula in the uterine cavity.

dominal crises except for the umbilical hernia mentioned above. There had been no episodes simulating either intra- or extra-uterine pregnancy.

On physical examination, slight tenderness was elicited in the right lower abdominal quadrant. There was a firm mid-line mass arising from the pelvis and extending to each side of the abdomen. The inguinal lymph nodes were palpable bilaterally. Pelvic examination revealed purplish discoloration of the vulva and the upper medial portions of the thighs. A large polypoid mass, hard and nontender, involved most of the left labium minus. The uterus and adnexa were not palpable. Five days after admission, the patient was taken to the operating room, where dilatation of the cervix and curettage of the uterine cavity were performed. The procedure yielded no curettings. A biopsy of the vulva showed epidermoid carcinoma.

Roentgenograms taken prior to the dilatation and curettage are shown in Figures 1 and 2. After the dilatation and curettage, a metallic cannula was introduced into the uterine cavity. Figures 3 and 4 show the results of the latter examination.

The gynecologic diagnoses were carcinoma of the vulva with metastases and lithopedion.

SUMMARY

A case of lithopedion in a 69-year-old patient with at least 27-year retention is presented because of the relative rarity of this occurrence as judged from the recent literature.

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Fig. 4. Lateral view of the pelvis with a cannula in the uterine cavity, showing the extra-uterine position of the lithopedion.

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SUMARIO

Litopedión: Historia Clínica y Estudio

Debido a la relativa rareza del fenómeno preséntase un caso de litopedión en una mujer de 69 años de edad, con una retención por lo menos de veintisiete años. El litopedión fué un hallazgo fortuito al examinar a la enferma con motivo de colporragia que resultó ser debida a carcinoma de la vulva con metástasis.

Bicephalic Monster: A Case Report[1]

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ACCORDING TO Science Service there have been 15 reported births of bicephalic monsters, 3 of which have been published in the past two years in the lay press. The case reported here we believe to be the first recorded instance in which the condition was recognized by roentgenograms prior to delivery. The obstetrical aspects, while interesting, are not our primary concern. This unusual development is said to be due to incomplete fission of two impregnated ova. A negative history for previous irradiation in this case may be of interest to radiologists.

Mrs. A. DeK., a 28-year-old white woman, was seen on Jan. 24, 1946. She had one child living and well. She had no miscarriages and her previous pregnancy was normal in every respect. Her last menstrual period had occurred on April 2, 1945. The Wassermann reaction was negative, and there had been no unusual diseases during the prenatal period. Mild nausea and vomiting had occurred during the first month of gestation. Menstruation had begun at the age of thirteen and had occurred regularly with periods of six days duration.

On physical examination the only findings were limited to the abdomen, which was unduly large even for full-term pregnancy. One head could be palpated overriding the pubis and a second could be felt by rectal examination. Just above the pubis was an unusual depression quite different from what is seen in the usual case of twins, and this led to further investigation. Roentgenograms were made at 1 P.M., Jan. 24, and the obstetrician was advised of the unusual condition by telephone. Shortly after leaving the office, the patient began having labor pains, and at 8 P.M. dilatation was complete, with membranes intact. A low cervical cesarean section was done at 9:15 P.M. by Doctor

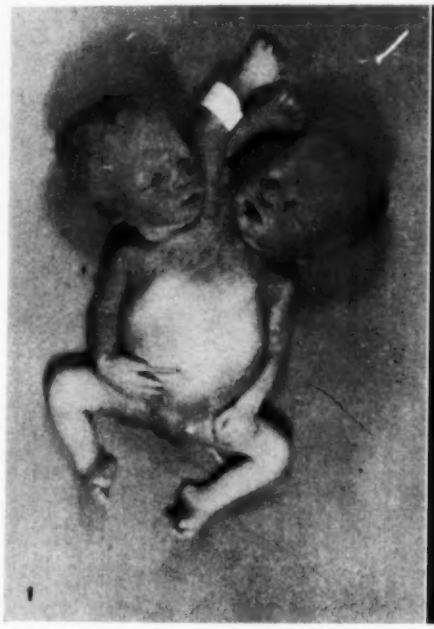

Fig. 1. Stillborn bicephalic monster.
Fig. 2. Bicephalic monster *in utero*. Note how the two spines come together at a single pelvis.

[1] Accepted for publication in April 1951.

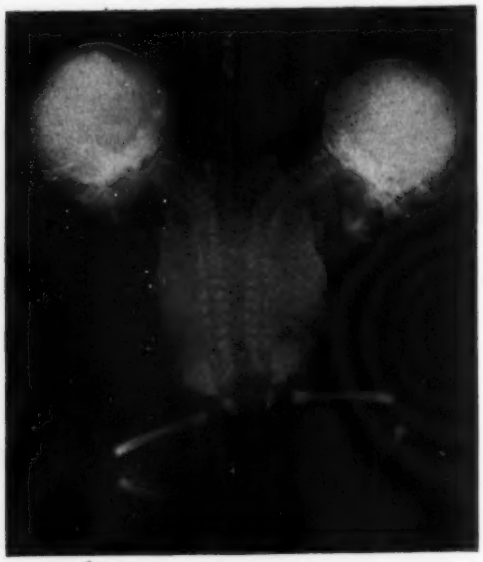

Fig. 3. Roentgenogram of stillborn fetus.

Sheeran, and a stillborn, bicephalic quadribrachial, bipedal male monster was delivered (Fig. 1). The mother's postoperative course was uneventful. There was a single placenta.

The roentgenograms showed two heads, four arms, fusion of the thoracic cages, two spines, but one pelvis and sacrum and only two legs. The latter finding made the diagnosis certain (Fig. 2). The skeletal systems are clearly shown in the roentgenogram of the stillborn fetus (Fig. 3.)

An autopsy was not permitted.

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SUMARIO

Bicefalia. Historia Clínica

Este parece ser el primer caso en que se descubriera en el útero la presencia de un monstruo bicéfalo y en que se reconociera el estado con las radiografías antes del parto. El monstruo, nacido muerto, tenía dos cabezas, cuatro brazos y dos piernas.

Comparative Study of X-Ray Transmission in Thorax and Abdomen in Living Subjects[1]

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IN THE COURSE of multiple-field radiotherapy to twelve cases of bronchogenic carcinoma it became apparent that delivery of an adequate tumor dose entailed considerable damage to the lungs. Tumor doses ranging from an estimated 5,000 to 9,000 r were usually followed by clinical evidence of a severe pneumonitis, almost invariably terminal in nature. Postmortem evidence in the great majority of the cases indicated extensive bilateral pneumonitis, often with fibrosis, and there was a growing impression that death had been secondary to radiation damage.

In an analysis of these unfavorable results, consideration was given to the possibility that estimation of the tumor dose had been in error and that an excessive amount had somehow been administered.

In a previous study (1), to demonstrate the distribution of energy within the thorax during multiple field and rotational therapy, it was shown that a plywood phantom of 0.5 density is probably more accurate for obtaining depth dose data applicable to the human thorax than the standard presdwood phantom of unit density. The percentage depth dose curve closely coincides with measurements in a fresh calf's thorax, and calves' tissues have been shown to have an absorption very similar to human tissues (2). A graph demonstrating the relative depth dose curves in air, the calf's thorax, and in plywood and presdwood phantoms is reproduced in Figure 1.[2] On comparing the doses at various depths in the plywood and presdwood phantoms, a considerable difference

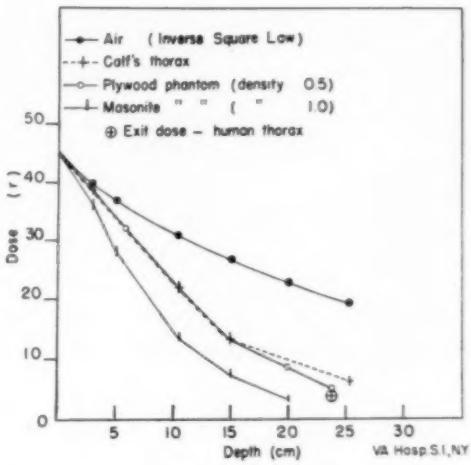

Fig. 1. Graph comparing depth dose curves in air, calf's thorax, and plywood and presdwood phantoms.

is noted. At depths of 5, 10, and 15 cm., for instance, the doses in the plywood phantom representing the thorax are respectively about 25, 55, and 70 per cent greater than in the presdwood phantom representing the abdomen, and hitherto used as standard. These differences between thorax and abdomen are considerable, and indicate that a substantial allowance should be made for treatment through the thorax, particularly when much lung parenchyma is to be traversed.

It was realized that phantoms, however perfect, can neither reveal the exact behavior of radiation in living human tissues nor indicate the undoubted variations which occur in different individuals for similar thickness of identical parts of the body. To know just what variations take

[1] Read by title at the Thirty-seventh Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 2-7, 1951.

Reviewed in the Veterans Administration and published with the approval of the Chief Medical Director. The statements and conclusions published by the authors are the result of their own study and do not necessarily reflect the opinion or policy of the Veterans Administration.

[2] The factors were 250 kv., 15 ma., 50 cm. T.S.D., 1 mm. Cu + 1 mm. Al, field size 7 × 15 cm., h.v.l. 1.5 mm. Cu.

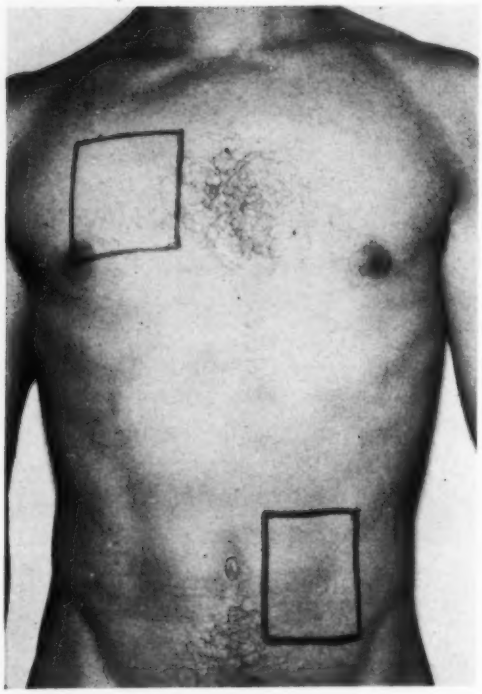

Fig. 2. Torso showing skin ports.

place throughout the body it would be most desirable to measure a range of depth doses in each of its various parts. This unfortunately cannot readily be accomplished. It was simple, however, to obtain exit doses through thorax and abdomen in a series of living subjects and to compare these. It was hoped that they would yield some indication of the differences in radiation dosage between a comparatively solid part such as the abdomen and a comparatively aerated part such as the thorax.

PROCEDURE

One hundred patients passing through the radiotherapy department were studied. Clarity of the lung fields roentgenologically was a prerequisite.

By the aid of folded sheets, the patient's chest and abdomen were slightly elevated, permitting a Victoreen thimble chamber to lie snugly between the back and the table top. First, an 8 × 10-cm. port with the long axis vertical was marked on the skin of the anterior chest (Fig. 2). Irradiation through the right lung field was favored to avoid interference by the cardiac apex. The diaphragm had been previously marked under fluoroscopy so that the lower limit of the port would clear it and the liver. The inner boundary of the port just cleared the mediastinum (Fig. 3A). A reading through chest wall and clear lung parenchyma, unmodified by absorption by any denser body structure, was the object of these precautions.

After the center of the port was identified, the anteroposterior diameter through that point was carefully measured. The thimble chamber was inserted beneath the part so that the tip lay in the central axis of the beam. An exposure was now applied to the field and the exit dose recorded. The factors were: 250 kv., 15 ma., 50 cm. T.S.D., 1 mm. Cu plus 1 mm. Al, h.v.l., 1.5 mm. Cu, calibration 40.6 r per minute. Two minutes continuous irradiation yielded an air dose of 81.2 r, and this dose, if not repeated, could hardly cause significant damage. Following this, the same procedure was repeated for the abdomen, the port lying on the left side, just clearing the spine (Fig. 3B).

The two-minute skin dose to chest and abdomen gave exit doses ranging from 1.9 to 26 roentgens; this exposure was esteemed a fair compromise between consideration of the patient's safety on the one hand and the inaccuracy inherent in reading very small quantities of x-radiation on the other.

These exit doses could not be regarded as absolute depth doses, since the therapy table did not provide an adequate back-scatter (measurement showed it to yield only approximately 7 per cent back-scatter); this circumstance, however, in no way detracted from their value as indicators of relative transmission by the two parts compared.

DISCUSSION

Inspection of the graph comparing exit doses in thorax and abdomen (Fig. 4) reveals several features of interest. Exit

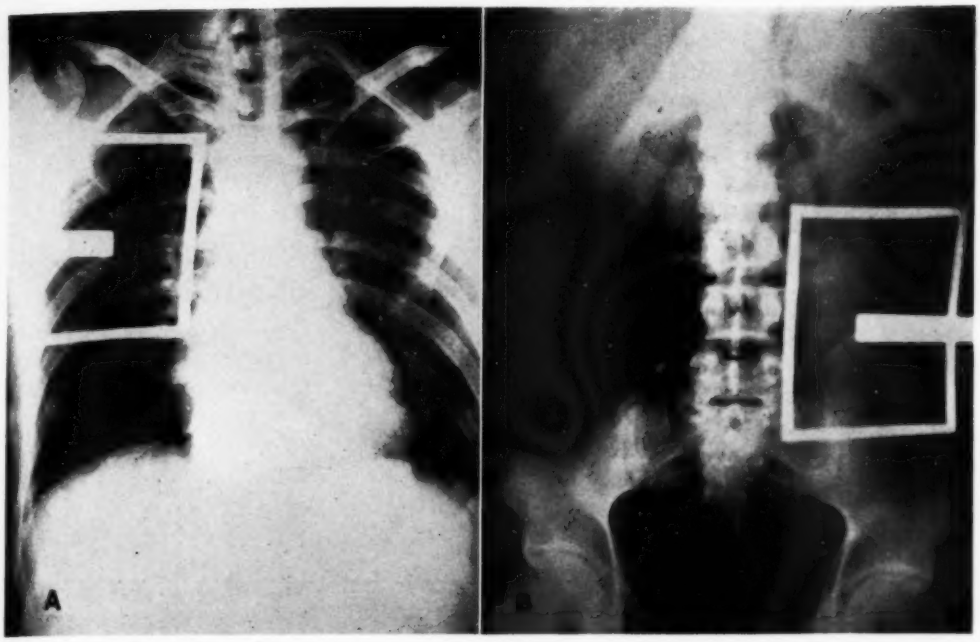

Fig. 3. Thimble chamber in place under ports. The tip of the chamber appears eccentric transversely because the tube is centered to the midline.

doses through the thorax are on an average two and a half to three times as great as those through an abdomen of similar thickness. A casual estimate by one unacquainted with these results would probably not have suggested so high a differential.

Further analysis of the above data and comparison of the graphs in Figures 1 and 4 disclosed percentage differences in depth dose in plywood (thorax) and presdwood (abdomen) which tend to confirm our experimental observations of the marked difference in exit dose through thorax and through abdomen. Further experimentation in living animals or human beings might reveal even greater differences in depth doses than shown by phantom study.

Another point of interest is the wide variation in exit dose for the same thickness of similar parts in different individuals. Differences of the order of 100 per cent occur in the abdomen and up to 250 per cent in the thorax. This wide range in thoraces of similar thickness is especially surprising and difficult to explain. In the abdomen the presence of intestinal gas probably has an influence. It would seem, however, that there are other factors, such as the varying absorptive capacity of individual tissues, skin, muscle, fat, bone and, possibly, intestinal contents. Differences in absorption in the lung parenchyma are probably negligible.

It is apparent that, if absorption can vary as greatly as this in different individuals, calculations of depth and exit doses based on a single standard phantom of homogeneous material and uniform, unvarying density throughout may be considerably in error. While true of the abdomen, this is all the more the case in the thorax. There, owing to the wide range of individual responses (Fig. 4), if one selects a midline as an average, individuals toward the extremes risk variance from the average by more than has hitherto been taken into account. Thus, if one bases his calculations on standard depth dose tables, he might conceivably give a considerably

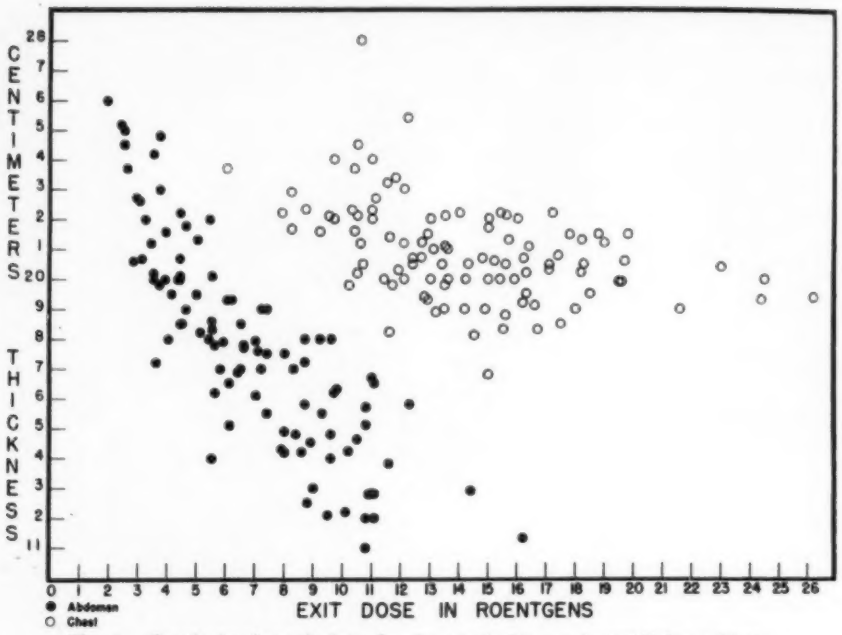

Fig. 4. Graph showing exit doses for chest and abdomen in 100 living subjects.

greater or smaller depth dose than intended.

While phantoms are at present the only means of obtaining graded depth readings, the results shown in the graph (Fig. 4) render desirable the exercise of ingenuity in obtaining depth readings in living human subjects by every possible means consistent with safety. In the meanwhile it would appear that each patient presents a separate radiotherapeutic problem and that clinical evaluation of the probable tissue capacity for transmission of x-rays, together with the radiotherapist's experience, should serve as a guide in modifying calculations based on standard tables.

NOTE: Most grateful acknowledgment is made to Dr. Edith Quimby for her kindness in reviewing and correcting the original draft of the manuscript.

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SUMARIO

Estudio Comparado de la Transmisión de Rayos X en el Tórax y el Abdomen de Sujetos Vivos

En 100 sujetos vivos determináronse las dosis de salida de rayos X a través del tórax y el abdomen con la esperanza de obtener alguna indicación de la diferencia en la dosis de rayos entre una parte del cuerpo comparativamente maciza, como es el abdomen, y otra comparativamente aireada, como el tórax.

Con exposiciones de dos minutos a 40.6 r por minuto (250 kv., c. de h.-r. 1.5 mm. de Cu), las dosis de salida variaron de 1.9 a 26 r. Las dosis transtorácicas de salida fueron, en conjunto, de dos y media a tres veces mayores que las que atravesaron un abdomen de espesor semejante. Notóse también mucha variación, llegando a 100 por

ciento en el abdomen y hasta 250 por ciento en el tórax, en la dosis de salida en partes semejantes del cuerpo del mismo espesor en distintos individuos.

Esos resultados indican que cada enfermo plantea un problema radioterapéutico distinto, y que la valuación clínica de la probable capacidad de los tejidos para la transmisión de rayos X, junto con la experiencia del radioterapeuta, deben servir de guía para modificar los cálculos basados en las tablas corrientes.

Relationship Between the Adrenal Cortex and Radiation Sickness

A Review of the Literature and a Presentation of New Data[1]

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IT HAS LONG BEEN theorized that the adrenal gland is associated in some way with radiation sickness (4, 7, 10, 12, 19, 25, 27, 33, 34) or with some of the effects of radiation (15, 16, 19, 23, 25). In the earlier years, the adrenal medulla was studied extensively as a possible source of information (7, 19, 23); more recently attention has shifted to the adrenal cortex (4, 12, 15, 16, 25, 27, 33, 34), which as early as 1922 was suggested as a potential factor by Hirsch (10) and others.

The theories on the relationship of the adrenal to radiation effects have been based on highly suggestive clinical, morphologic and pharmacologic findings. When these are assimilated in the light of present knowledge, the evidence becomes even more provocative. Some of the earliest work was done by Hirsch, who used anterior pituitary extracts and adrenal cortical extracts to prevent radiation sickness with some success, but found that posterior pituitary extracts had no apparent effect.

Desjardins (7) quoted Tsuzuki as showing in 1926 that in rabbits given a lethal dose of radiation there could be demonstrated at autopsy (1) reduction of the fat content in the adrenal cortex, (2) degeneration of medullary cells, and, after extreme doses, (3) atrophy of the medulla.

The highly significant work of Leblond and Segal (16) demonstrated convincingly that heavy irradiation of lymphatic tissue, with adequate shielding of the rest of the body, will produce hypertrophy of the adrenal cortex and involution of distant lymphatic organs, while in adrenalectomized subjects such involution does not occur.

Martin, Rogers and Fisher (19) quoted Arrillaza and Izzo as describing a case of Addison's disease in which the patient died five days after receiving a routine series of x-ray treatments to a carcinoma of the tonsil. Attributing this to a lack of adrenalin, they heavily irradiated the remaining adrenal gland of a dog from which one adrenal had been removed. The irradiation was carried out through an operative wound, allowing a close target-subject distance. The dog suffered no ill effects, and autopsy twenty-six days later showed complete destruction of the adrenal medulla with viable islands of cortex surrounded by bands of fibrous tissue.

Warren (33) reported that leukopenia and loss of lipoid from the adrenal cortex were common findings in the victims of the atomic bombing. He could not be sure, however, that these morphologic findings were not the result of "alarm" stimuli other than irradiation.

Weichert (34) noted the striking similarity between Addison's disease and severe irradiation sickness and theorized that the toxic products of protein breakdown in irradiation produce a relative adrenal cortical insufficiency. He observed improvement in his patients after administration of desoxycorticosterone.

Craver (4), from observations on mice, postulated that the adrenal cortex was necessary in some way to repair the general tissue damage resulting from irradiation.

Selye (25), in his monumental thesis on the general adaptation syndrome, cites considerable evidence to indicate that heavy irradiation can produce the "alarm reaction" and its sequelae in the same fashion as other forms of stimuli. This

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syndrome can, of course, be produced by a variety of stimuli. In 1941, however, probably for the first time, Moon, Kornblum and Morgan (20) demonstrated that irradiation could in fact produce the characteristic findings of true shock, and suggested that actually irradiation sickness may be a form of shock. Their experiments on dogs showed that heavy irradiation (1,400–2,800 r to the abdomen in a single dose of 130-kv. radiation) produced anorexia, vomiting, diarrhea, anuria, hemoconcentration, and death from circulatory failure. Autopsy revealed capillary hemorrhages in the mucosa of the intestinal tract, mottling and cyanosis of the lungs, mucosal edema, and contraction of the spleen—in short, the characteristic findings of shock from any cause except hemorrhage. Nor is this picture produced solely by irradiation over the abdomen. Leblond and Segal noted similar changes in the viscera of rats treated with heavy doses of radiation with the abdomen shielded.

The work of Pearson *et al.* (22) and others (8), using ACTH and cortisone to induce involution of lymphoid tumors, coupled with the clinical observations of many radiologists that irradiation of one lymphatic tumor may produce decrease in the size of distant nodes, further connects the action of the adrenal cortex with the effects of irradiation.

Most of the evidence cited above has been obtained with extremely heavy or lethal doses of radiation on animals. Where human subjects were involved (10, 33, 34), the evidence has been confirmatory but not conclusive.

It is the purpose of this paper to present further substantiation of the relationship between the adrenal cortex and irradiation, as well as to suggest its pattern. This new evidence has been gained from studies on patients undergoing routine radiation therapy.

EXPERIMENTAL TECHNIC

At the time this study was planned the question arose as to how best to demonstrate the possible response of the adrenal cortex to irradiation. It has been known for some time, and reiterated by many authorities (25, 28, 30), that the level of the 17-ketosteroids in the urine is an accurate index of adrenal cortical activity, with elevation of the titer indicating activity. More recently it has been shown (24, 26, 29, 30) that close observation of the level of circulating eosinophils is a reliable and practical method of following adrenal cortical response, *marked depression of the count* occurring as a *result of cortical activity*. The latter method was chosen as being the most satisfactory for use in patients of the type to be studied, most of whom were outpatients receiving daily treatments. In a few selected cases 17-ketosteroid determinations were also obtained.

Thirty-six patients were studied. No selection was exercised at first, but as the pattern of response became obvious, the later cases were selected with a view to allowing closer observation. With few exceptions, the patients were being treated for some form of malignant disease. The diagnoses are recorded in Table I. Treatment was carried out with a variety of technics, as would be expected in the routine work of a busy radiation therapy department. The factors were: 200, 1,200, and 2,000 kv., with half-value layers of 0.9, 9.0, and 13.1 mm. Cu and skin-target distances of 50, 70, and 100 cm., respectively. Table I gives the factors used in each case.

Eosinophil counts were performed daily or, when this was impossible, at frequent intervals before, during, and after the treatment period. All of the counts were done by the same person[3] and were accompanied in almost every instance by a white blood count. The technic of counting was that employed by Hunter (11) on capillary blood. Two separate white blood cell pipettes were used, and the average variation between the two was only 4 to 6 per cent, with a maximum variation of 10 to 15 per cent.

[3] E. C. Porter, M.D.

TABLE I: DETAILS OF

Patient	Age	Diagnosis	Medication	Kv.	H.v.l. mm. Cu	Ports	Daily Dose per Port	Total Air Dose per Port
1	42	Hodgkin's disease	None	200	0.9	(2) 20 × 20 Chest (2) 8 × 10 Groin	200 300	1,000 900
2	29	Hodgkin's disease	None	200	0.9	(1) 10 × 10 Axilla	300	900
3	64	Carcinoma of lung; chronic nephritis	Cardiovascular; sedatives	1,200	9.0	(2) 12 × 18 Chest	150–300	1,000
4	63	Polycythemia vera	None	200	0.9	Open Spray	15	210
5	38	Carcinoma of breast with metastases	Testosterone 30 mg. twice a week. Dramamine 50 mg. twice daily	200	0.9	(2) 10 × 15 Breast (1) 10 × 20 Spine	200–300	2,100 1,400
6	52	Hodgkin's disease	None	200	0.9	(1) 8 × 10 Axilla	200–300	1,100
7	63	Lymphosarcoma	Terramycin	200	0.9	(1) 6 × 8 Neck (2) 8 × 10 Axilla	300	1,200
8	82	Carcinoma of breast	None	200	0.9	(2) 10 × 15 Breast	300	1,800
9	34	Malignant lymphoma, follicular	None	200	0.9	(2) 10 × 20 Chest	200–300	1,500
10	65	Reticulum-cell sarcoma	None	200	0.9	(2) 20 × 20 Chest wall	300	1,500
11	69	Polycythemia vera	None	200	0.9	Open Spray	15–25	240
12	57	Carcinoma of prostate; osseous metastases	Estradiol 1.25 mg. p.o. four times daily	200	0.9	(1) 10 × 20 Shoulder and neck	300	1,500
13	32	Myelogenous leukemia	None	200	0.9	(1) 20 × 20 Spleen	200	800
14	64	Carcinoma of hypopharynx	None	200	0.9	(2) 8 × 10 Larynx	200–300	3,500
15	71	Carcinoma of prostate; bony metastases	Stilbestrol 5.0 mg. t.i.d.	200	0.9	(2) 20 × 20 Pelvis	200–300	1,300
16	66	Adenocarcinoma of endometrium	Cardiovascular	1,200	9.0	(2) 20 × 20 Pelvis	200–300	2,000
17	70	Ulcerated carcinoma of breast	Stilbestrol 5.0 mg. t.i.d.	200	0.9	(4) 10 × 20 Both breasts	300	2,100
18	51	Carcinoma of lung	None	1,200	9.0	(2) 15 × 20 Chest	200–300	3,000
19	61	Chronic lymphatic leukemia	None	200	0.9	(1) 10 × 10 Axilla	300	1,200
20	41	Malignant melanoma; metastases	None	200	0.9	(1) 10 × 10 Groin	300	900
21	72	Carcinoma of lung	None	1,200	9.0	(2) 16 × 16 Chest	300	2,100
22	56	Inflammatory carcinoma of breast	None	200	0.9	(2) 10 × 20 Breast (1) 8 × 10 Supracl.	300	3,000 2,100
23	66	Inflammatory carcinoma of breast	None	200	0.9	(4) 20 × 20 Breast (2) 8 × 10 Nodes	300	2,100 600–1,500
24	65	Carcinoma of lung	None	1,200	9.0	(2) 12 × 20 Chest	200–400	4,800
25	68	Lymphoma, lymphocytic	None	200	0.9	(1) 4 × 5 Eye	300	1,200
26	31	Myasthenia gravis	Prostigmine	1,200	9.0	(2) 12 × 12 Mediastinum	200–300	1,400
27	44	Pancoast tumor	Codeine	1,200	9.0	(2) 15 × 15 Chest	300	3,900
28	66	Chronic lymphatic leukemia	None	200	0.9	(2) 10 × 10 Axillae	300	900
29	41	Chromophobe adenoma	None	2,000	13.1	(4) 4 × 4 Pituitary	300	1,200
30	36	Neurofibrosarcoma	None	1,200	9.0	(2) 20 × 20 Chest	200–300	2,700
31	52	Carcinoma of lung	Penicillin	1,200	9.0	(2) 12 × 20 Chest	300	300
32	47	Carcinoma of lung	None	1,200	9.0	(2) 20 × 20 Chest	200–300	3,000
33	50	Carcinoma of breast; metastases	None	200	0.9	(2) 20 × 20 Chest	200	1,000
34	66	Carcinoma of breast, ulcerated	Estradiol 4.0 mg. daily	200	0.9	(2) 10 × 20 Breast	300	2,100
35	54	Reticulum-cell sarcoma of bone, multiple	None	200	0.9	(2) 10 × 20 Spine (2) 8 × 10 Axilla	300	1,200
36	38	Renal-cell carcinoma	Dramamine 50 mg. daily; Pyridoxine	1,200	9.0	(2) 20 × 20 Abdomen	150–200	1,600

Est. Tumor Dose	Radiation Sickness*	Other Symptom Change†	Other Objective Change†	Eosinophils at Start	Eosinophils at Low	Leukopenia	Eventual Response	Remarks
1,000	Nausea++	None	None	300	28	No	Good	
700								
700	Nausea+++ Vomiting+++	None	Nodes−	21	6	No	Good	
1,000	No	Uremic coma	Uremic coma	6	0	No	....	Died of uremia before completion of treatment
...	No	None	None	210	160	Yes	Good	
...	Nausea++	Relief of pain	Tumor decreased	193	62	No	?	
...	No	None	Nodes −	62	55	No	Good	
...	No	Improved	Nodes −	109	100	No	Excellent	
...	No	None	Mass −	137	137	No	Excellent	
...	No	Improved	Fluid −	253	148	Yes	Fair	See Chart 4
...	No	Improved	Mass −	160	100	No	Excellent	
...	No	None	None	375	275	No	?	Nausea q.d. when treated only. "Psychological" sickness
...	No	Pain −	None	125	91	No	Slight	No change in 17-ketosteroids in urine. See Chart 5
...	No	None	None	125	125	No	Poor	"Clumping" made accurate count impossible
6,900	No	None	Wet radiation reaction	156	106	No	Excellent	
...	Nausea+++ Vomiting+++	Pain −	None	303	115	No	Slight	
2,000	Nausea++ Vomiting++	None	None	50	50	No	?	Rising count with secondary drop. See Chart 3.
...	Nausea+	None	Wet radiation reaction	12	6	Yes	Good	
3,000	Nausea++ Vomiting++	None	None	115	50	No	Good	
...	No	None	None	38	37	No	Good	
...	No	None	None	60	60	No	None	
2,100	No	Pain −	None	94	93	No	?	
5,000+	Nausea±	None	Mass −	208	137	Yes	Good	Eosinopenia coincided with nausea, but not significant drop
...	Nausea++++ Vomiting++++	None	Weakness increased	25	12	Yes	....	Treatment stopped because of radiation sickness
5,000+	Nausea+	None	Skin reaction +	178	70	Yes	Fair	Eosinopenia before nausea
...	No	None	Mass −	446	428	No	Good	
...	No	None	None	94	65	No	None	Count doubled one day
4,500	Nausea±	None	Mass −	214	114	No	Fair	Eosinopenia coincided with nausea but not significant drop
...	No	None	Nodes −	492	345	Yes	Excellent	
3,500	No	None	None	102	81	No	Improved	Rising count, unexplained Highest = 296
3,000	Nausea++	None	None	153	31	No	?	
...	No	None	None	162	156	No	....	Treatment stopped. Patient transferred
4,000	Nausea+++	None	Mass −	130	25	No	?	Coincident rise in 17-ketosteroids in urine with eos. drop. Slight increase NPN. See Chart 1
...	Nausea++ Vomiting++	None	None	98	37	No	?	No coincident rise in 17-ketosteroids; later increase noted
...	No	None	Wet radiation reaction	81	50	No	?	
...	No	Pain −	None	110	81	No	?	
...	Nausea+++ Vomiting+++	None	None	200	12	No	?	See Chart 2

* ± Very slight. + Slight. ++ Moderate. +++ Severe. ++++ Marked.

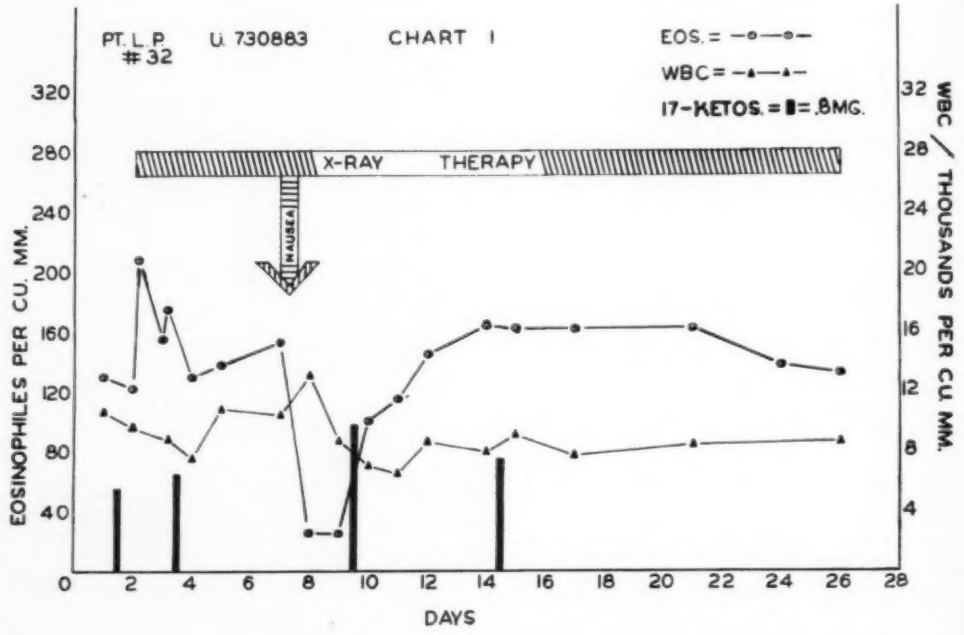
† − Decrease.

The eosinophil counts were made at approximately the same time each day and, in order to avoid a possible depression of eosinophils due to food intake, at least an hour was allowed to elapse after the patient had eaten.

On only 5 patients were 17-ketosteroid urinary levels obtained. The Albright technic was employed.

Careful note was made of any medication being taken by the patient and of any subjective or objective change.

sickness preceded the fall in the count by several hours, usually not exceeding twenty-four hours. In the one exception the fall in the count preceded the onset of nausea by ten days. It is only fair to state, however, that this patient was one of 4 in this group who had had nausea or vomiting prior to treatment, and it was necessary to rely on these patients' statements that their symptoms had become suddenly and significantly worse. This information was volunteered by 3 patients, but Patient 24

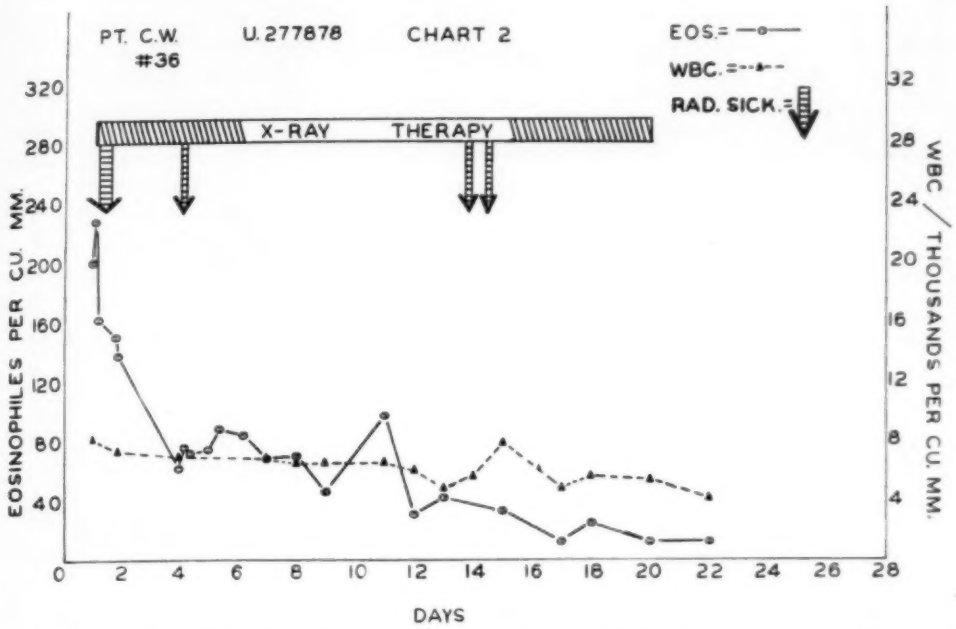


EXPERIMENTAL FINDINGS

Inasmuch as there is considerable normal daily variation in the eosinophil count, a depression of at least 50 per cent from day to day was the criterion set for abnormality (30).

As one may see from Table I, all of the patients in whom a significant depression of the eosinophil count occurred in the course of treatment suffered from some form of radiation sickness, either severe nausea alone or a combination of nausea and vomiting. There were 10 patients in this group. In all but one (Patient 24) the denied any such change in his symptoms.

Twenty-six patients showed no significant depression of the eosinophil count. Four of these patients (Patients 2, 3, 17 and 23, Table I), however, started therapy with abnormally low counts. In 3 of these radiation sickness developed immediately after the first treatment, and in 2 (Patients 2 and 23) it was severe. In Patient 23 it was necessary to stop treatment because of the sickness. Patient 3 was already in uremia at the beginning of treatment and died of uremia a few days later. These patients were not included in

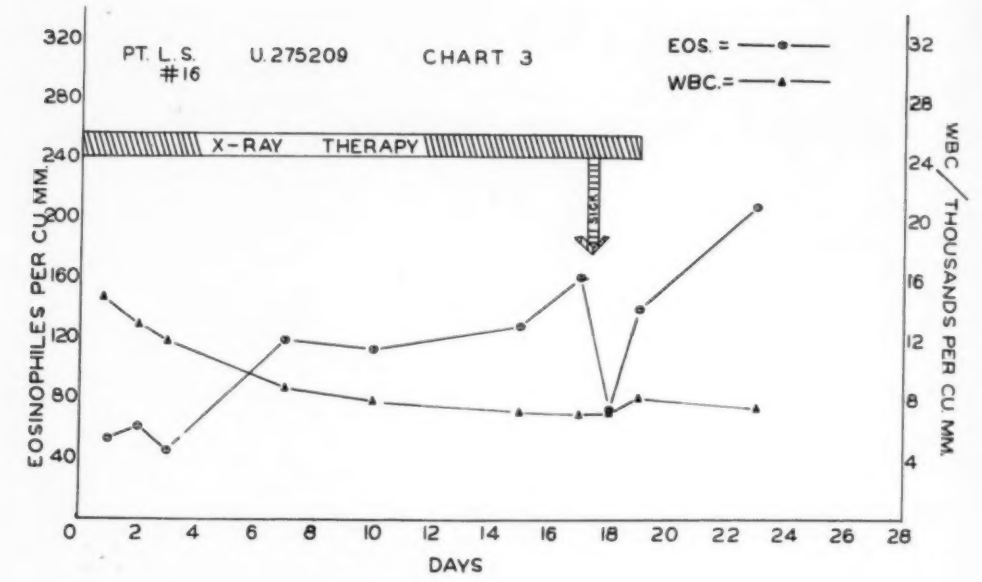


the above group of 10 patients inasmuch as their initial counts were too low to be of much value in judging the significance of the drop.

Of the 22 patients who did not show a significant depression of the eosinophil count during therapy, none showed evidence of vomiting; only 4 were nauseated. Two of the latter 4 (Patients 22 and 27) had appreciable but not significant drops in the counts following very slight bouts of nausea (or "severe loss of appetite," as one patient described it). Another of the 4 (Patient 21) who had complained of nausea even before treatment noticed no change during the course of therapy. The fourth (Patient 11), on entering the therapy room, experienced slight nausea but this disappeared within an hour after he left the department. This suggests the presence of a very definite psychologic factor.

The typical response of the eosinophil count in those patients in whom radiation sickness developed is shown on Charts 1, 2, and 3. Within several hours after the onset of nausea or vomiting there was a rather abrupt drop in the count. In Patient 32 (Chart 1) 17-ketosteroid determinations were made on the urine, showing a significant rise at the period of greatest adrenal cortical activity, which is further confirmation of the nature of the response. In this particular case the eosinophil count rose again to normal. Patient 36 (Chart 2), however, showed another type of response, namely, persistent depression of the eosinophil count following the initial response. As may be seen, repeated bouts of sickness occurred during the remainder of treatment, although none were as severe as the first. The temporary rise in the count on the eleventh day cannot be explained except for the fact that no treatment had been given on the preceding day (Sunday).

Another, more peculiar type of response was that of Patient 16 (Chart 3), who exhibited a steadily rising count interrupted by an abrupt depression following one attack of radiation sickness. There is no ready explanation for the rising count. Similar findings were noted in Patient 29, who was being treated for a chromophobe adenoma. In this case, however, the count continued to rise and no radiation sickness occurred.



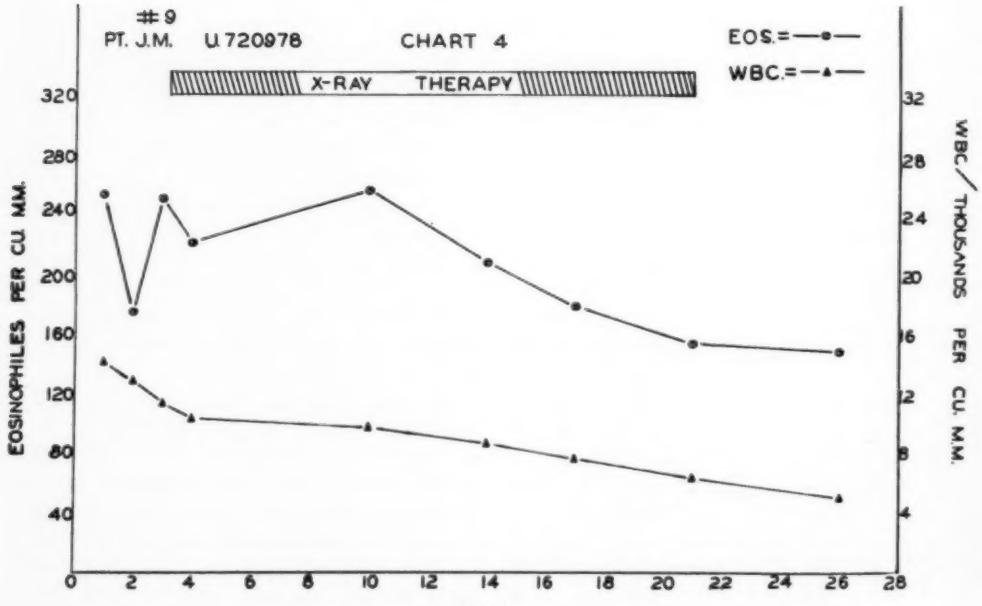
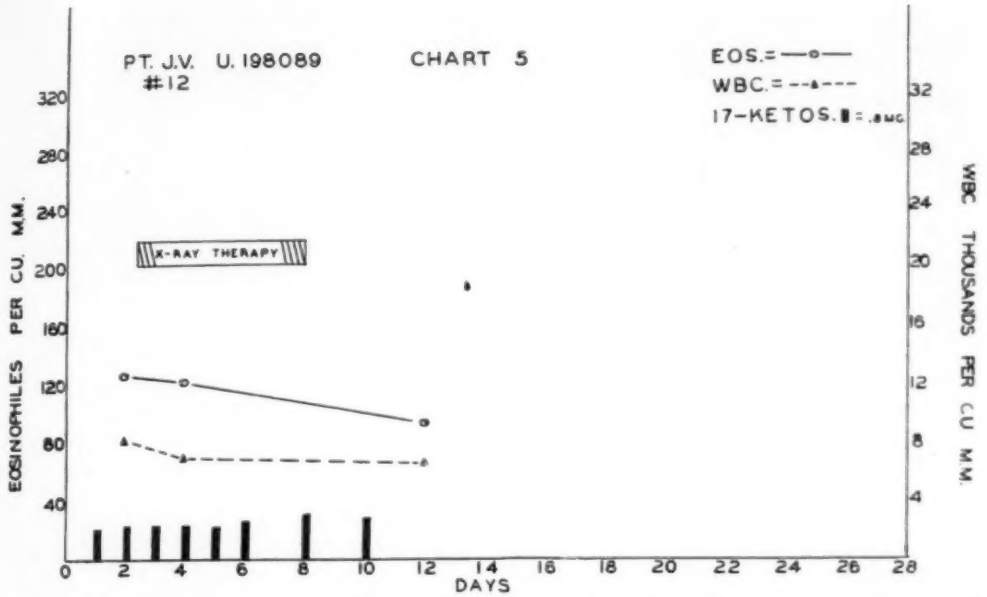


Chart 4 depicts the eosinophil levels in a patient in whom radiation sickness did not develop (Patient 9). The gradual slight depression of the count can be adequately explained on the basis of progressive leukopenia. Chart 5 reveals a similar situation with 17-ketosteroid determination showing no significant change during the course of therapy (Patient 12).

As demonstrated in Charts 1 and 2, there was frequently a sharp rise in the count within a few hours following the first treatment, the significance of which was not determined. This phenomenon, how-



ever, has been reported previously by Lawrence and his associates, quoted by Cronkite (5).

In all but one of the patients in whom radiation sickness developed there appeared to be a definite time relationship between subsidence of symptoms and depression of the count, suggesting that the adrenal cortical response was a factor in controlling the sickness. In a few cases, as in Patient 15 and to a lesser degree in Patient 32, there developed a slight eosinophilia shortly after the depression. This is suggestive of the "third-day eosinophilia" described by Thorn and his group (24) in their study of surgical patients.

Patient 36, whose response is shown in Chart 2, had pyridoxine and dramamine therapy without apparent effect on the count. Patient 5 was given testosterone and dramamine during the entire course of her roentgen therapy and no relationship to the fluctuation in the count could be established. Furthermore, these drugs did not prevent the development of sickness. As has been stated, the *symptoms in these patients, as in the non-medicated ones, cleared with the dropping of the eosinophil count even though treatment was continued unchanged.* Additional bouts of sickness occurred both in those whose counts returned to normal levels and in those whose counts remained low, although the latter seemed to have more difficulty in this regard. In either event, *clearing of the initial attack of sickness coincided with the drop in the eosinophil level.*

Of the 5 patients for whom 17-ketosteroid studies were made, it was possible to follow only 3. One died before adequate follow-up was obtained and one was transferred to another hospital after his first treatment. In 2 of the 3 who were followed sickness developed. Both showed a significant increase in the 17-ketosteroid excretion level after the drop in the eosinophil level. One of the 2 (Patient 32) is depicted in Chart 1; in the other (Patient 33) the 17-ketosteroid output was doubled, but the elevation came later in the course of therapy and did not coincide with the initial eosinophil response. The third patient (Patient 12, Chart 5) showed no significant elevation of the 17-ketosteroid excretion level nor did he develop eosinopenia or radiation sickness during the course of irradiation.

Blood chemistry studies were done in only one instance, Patient 32. These included sodium, chloride, potassium and

non-protein nitrogen determinations. No significant change was noted.

No apparent correlation could be detected between the development of eosinopenia and the eventual response of the tumor to radiation.

DISCUSSION

Despite the small number of patients presented here, it is believed that the findings are so consistent as to be highly significant. Correlation of these findings with known facts offers even more substantial evidence of the action of the adrenal cortex in radiation sickness. It has been demonstrated that in this group of patients, as a general rule, the *presence of adrenal cortical activity*, as shown by the fall in the eosinophil count, and in Patient 32 by the concomitant rise in the level of 17-ketosteroid excretion, is *evident only following the onset of radiation sickness*. In other words, despite the use of large fields and dosage equivalent to that used in those cases in which sickness develops, no such detectable adrenal response occurred *if there was no sickness*. On the other hand, sickness seemed to occur more readily and/or with considerable severity in those few cases with abnormally low eosinophil counts at the beginning of therapy, and in those cases, illustrated by Patient 36, in which low counts were maintained after the initial depression.

It should be noted additionally that 4 of the patients in the first group had had some nausea and even vomiting prior to the onset of therapy, which had not affected the eosinophil count; while in the same group there are individuals whose radiation nausea alone was sufficient to bring about the response. Furthermore, the long recognized phenomenon, already mentioned in these cases, should be remembered—that is, that radiation sickness often disappears within a few hours despite continued application of treatment and the failure to administer medication. This occurrence, which many radiologists have observed, can be easily explained on the basis of the findings presented herein. For, as may be seen in all of the cases in the first or "radiation-sick" group, the nausea or vomiting promptly disappeared as soon as the eosinophil count dropped to its lower level, thus indicating adrenal cortical activity. These patients then would fit into Selye's first stage of "alarm reaction," with the radiation sickness representing the "shock phase," as has been suggested by Moon and his fellow-workers (20), and the adrenal response occurring in the "counter-shock" phase.

Several of the patients, as demonstrated by the graph in Chart 2, remained in the phase of adrenal cortical response during the remaining course of their therapy, thus entering the "stage of resistance." In this stage, because of lowered adrenal reserve, it may be argued that they were more susceptible to alarm stimuli and manifested this by repeated slight bouts of sickness. The 4 patients who began therapy with low eosinophil counts may be characterized as already in the "stage of resistance," either from the extent of their disease or other alarm stimuli such as operation or previous irradiation.

Further evidence to suggest this explanation is to be found in the literature, for although no significant change in the electrolyte balance was noted in the one patient on whom studies were obtained, many workers have reported that chloride retention, as indicated by marked decrease in the chloride content of the urine, does occur in association with radiation sickness. Cameron and McMillan (2) carried out chloride determinations on 4 patients undergoing radiation therapy. In the 2 in whom radiation sickness developed, the chloride retention coincided with the sickness, while in 1 of the 2 who were not sick chloride retention did not occur and in the other it was of insignificant degree.

Cori, Pucher, and Goltz (3) studied the urines of three patients undergoing radiation therapy. All 3 patients had radiation sickness and showed increased nitrogen excretion in the urine. The authors, however, were at a loss to explain the severe chloride retention, which developed twenty-

four to forty-eight hours after the onset of the sickness. They noted that the more severe the sickness the greater was the ensuing retention of chlorides.

If these findings are borne in mind and if it is remembered that chloride retention has not only been described in the "counter-shock" phase of the "alarm-reaction" (25) but has also been demonstrated to be a characteristic action of cortisone in clinical usage, it then becomes apparent that here is further suggestive evidence of the role of adrenal cortex in radiation sickness.

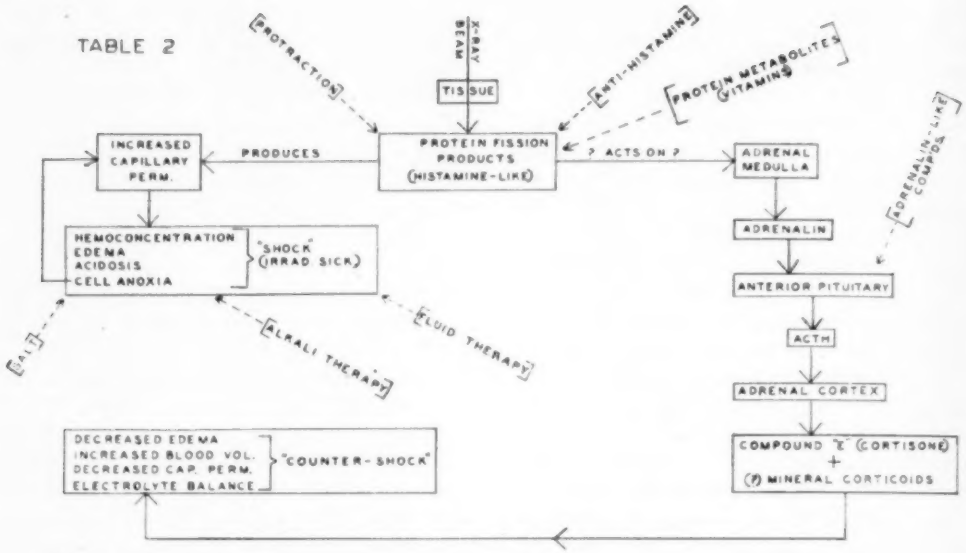
If it is assumed from the evidence presented that such a relationship does exist, it might well be asked how its mechanism is set in motion; in other words, how does x-ray irradiation produce the sickness? This, of course, is not definitely known, but considerable data on the subject have appeared in the literature, and many competent opinions have been expressed. Selye (25), for instance, basing his opinion on the findings of others, has suggested a possible series of events: that the action of protein fission products on the capillaries produces increased permeability and resultant hemoconcentration, thus initiating the vicious cycle of shock. This theory has, of course, been voiced by many others (12, 16, 17, 20, 34). The work on which it is based, illustrating an increased nitrogen metabolism during radiation therapy, has emanated from varied sources. Leblond and Segal (16) quote Segal as showing an increased histamine content in the blood during therapy. Cori, Pucher, and Goltz showed increased nitrogen output in the urine, as has already been mentioned. Loiseleur (18) was actually able to titrate abnormal protein breakdown products in the blood of irradiated animals. Warren and Whipple (31) quote Hall and Whipple as finding an increased nitrogen metabolism, at times with an elevated non-protein nitrogen. Whether these protein fission products act to produce shock by increasing capillary permeability or by some direct action on the hormonal system is, of course, not proved, but the evidence is certainly suggestive that these toxic protein products may indeed be the actual agents by means of which the "shock-phase" or radiation sickness is instituted (12, 20, 26). In further support of this theory is the observation of many radiologists that three factors figure in the instigation of true irradiation sickness as opposed to psychogenic sickness, any one—or more—of which may produce the response. These three factors are: (1) large fields, (2) sufficiently heavy dosage, (3) a very radiosensitive tissue. A study of these factors suggests that tissue breakdown may be the common denominator in the production of radiation sickness.

As all radiologists know, treatment over the upper abdomen, even with low dosage and small fields, can easily produce radiation sickness. This observation has a logical explanation, since it is common knowledge that one of the most radiosensitive of the normal tissues in the body is the mucosa of the small intestine. When the treatment field is shifted elsewhere, unless a highly radiosensitive tissue is included, higher dosages or larger fields are usually found necessary to produce radiation sickness.

In view of these considerations, the treatment of irradiation sickness as a possible clue to its etiology and course may well be examined. Radiation sickness frequently subsides abruptly by itself, even though treatment is continued and no medication is administered, the patient apparently "treating" himself through the mechanism of his own adrenal cortical response if the evidence presented herein is accepted. This phenomenon may well account for many of the "good responses" to medication quoted in the literature.

On the other hand, examination of Table II indicates how many medications may actually have pharmacologic effect at various points in the cycle. If the assumption is accepted that the mechanism as shown in this chart represents a rough outline of what in fact does take place, it becomes apparent that the various types of medication could easily fit into the pattern. Steinberg (27) reviewed many of the agents

TABLE 2



used in the treatment of radiation sickness—protraction of irradiation, liver extract, vitamin preparations (thiamin, pyridoxine, etc.), high salt intake, alkalis, adrenal cortex, adrenalin and adrenalin-like compounds, cholesterin or its derivatives, and sedatives; all have a function which could be utilized.

In the light of the evidence from the literature and the present substantiating new evidence concerning the physiology of radiation sickness, the following hypothesis is suggested:

Ionizing radiation, by virtue of its action on cells in a still somewhat obscure mechanism, causes breakdown of protein molecules into fragments, some of them perhaps histamine-like in their make-up, which, in sufficient quantities, may produce a state of chemical shock called "irradiation sickness." It is believed that the adrenal cortex, through its production of cortisone, *is the decisive factor in eradicating this state of shock by counteracting the physiologic imbalance which exists.*

This study further suggests the possible use of cortisone as a protective agent against irradiation sickness. Animal experimentation along these lines should be carried out without delay.

It appears further that the presence of marked eosinopenia (*i.e.*, below 25/mm.^{3}) may be of importance in predicting a state of adrenal reserve insufficient to tolerate a practical degree of irradiation. At present, insufficient evidence exists for any positive statement, but certainly the possibility of eosinopenia as a prognostic test should be investigated. Addison's disease should, of course, be a contraindication to irradiation unless cortisone proves adequate to control the patient during the treatment.

SUMMARY AND CONCLUSIONS

1. The literature pertaining to the relationship of the adrenal gland to irradiation has been briefly reviewed.

2. Thirty-six patients undergoing radiation therapy were studied by means of eosinophil counts; in 5 of them determination of 17-ketosteroid excretion levels was also carried out.

3. With few exceptions a definite adrenal cortical response was noted in those patients in whom radiation sickness developed. No such response was noted in those without radiation sickness.

4. It is believed that the adrenal response is a major factor in alleviating radiation sickness.

5. Eosinopenia prior to therapy may be of importance in predicting the development of radiation sickness.

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Hartford, Conn.

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(Para el sumario en español, véase la página siguiente.)

SUMARIO

Relación entre la Corteza Suprarrenal y la Enfermedad Irradiatoria: Repaso de la Literatura y Presentación de Nuevos Datos

El A. ha tratado de comprobar las observaciones ajenas acerca de la relación que existe entre la corteza suprarrenal y la irradiación, y también de indicar el patrón que reviste. Sus datos fueron obtenidos en los estudios de 36 enfermos que recibían radioterapia. Como método fidedigno y práctico para observar la respuesta córticosuprarrenal a la irradiación, se tomó la cifra de los eosinófilos en la circulación. En 5 enfermos, se determinaron además las cifras de excreción de 17-quetoesteroides.

En 10 enfermos hubo una baja significativa de la fórmula eosinófila, y todos ellos padecían de alguna forma de enfermedad de la irradiación. No se observó respuesta córticosuprarrenal en los pacientes que no padecían de dicha enfermedad. Sólo se mantuvo en observación a 3 de los enfermos en que se hicieron estudios de los 17-quetoesteroides; 2 de ellos mostraron aumento de la excreción de 17-quetoesteroides después de descender la eosinofilia.

Sugiérese que la corteza suprarrenal, por virtud de su producción de cortisona, representa el factor decisivo en la erradicación del estado de choque químico llamado enfermedad irradiatoria, por contrarrestar el desequilibrio fisiológico debido a los efectos de la radiación yonizante. Eso indicaría la posible utilidad de la cortisona como elemento protector contra dicha enfermedad, y además que la presencia de una eosinopenia intensa puede revestir importancia para predecir un estado de reserva suprarrenal insuficiente para tolerar una dosis práctica de irradiación.

A Simple Accurate Plane and Incline Indicator[1]

A. L. L. BELL, M.D., and JEROME ZWANGER, M.D.

Brooklyn, N. Y.

AT THE LONG ISLAND College Hospital (Brooklyn, N. Y.), where a large number of myelographic examinations are performed, it has become apparent to us that a simple means for recording on film the degree of table inclination would be of great value. Accordingly, we have designed a simple indicator which records accurately the degree of table tilt on each spot film.

This indicator consists primarily of a mercury droplet enclosed in a hollow glass tube which has been bent to form a semicircle and sealed at both ends. The tube is encased in a block of wood or plastic

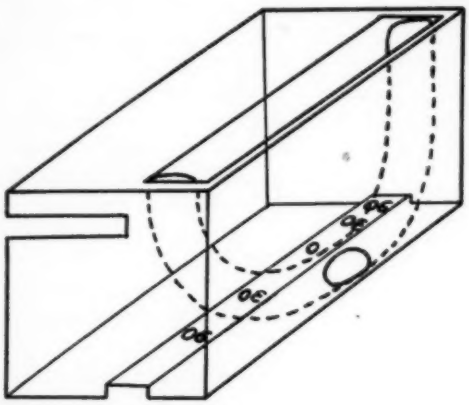


Fig. 1. Schematic representation of indicator showing semicircular glass tube containing mercury droplet and enclosed in a wood block.

(Fig. 1) so grooved that it may be affixed to the spot-film device. The system is semiopaque except for the mercury droplet; thus a shadow will be cast on both the fluoroscopic screen and the exposed film. The glass tube will appear as a rectangular column, within which lies the opaque droplet. Since the indicator depends upon gravity for operation, it follows that the mercury droplet will appear in the center

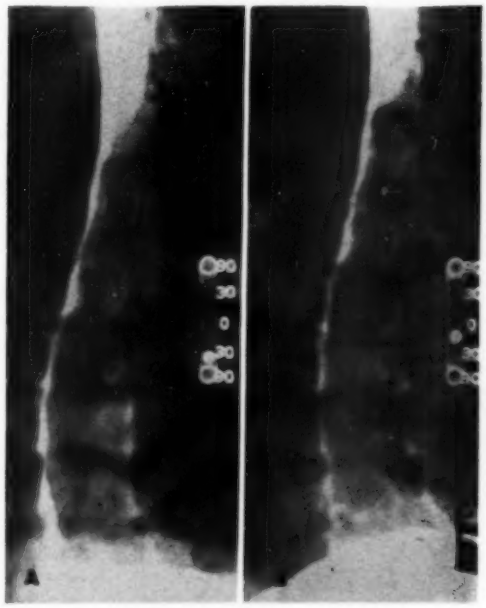


Fig. 2. A. Myelogram made with patient tilted about 45 degrees cephalad. Note partial obstruction to the column of pantopaque.
B. Myelogram of same patient tilted 15 degrees cephalad. The lesion proved to be an ependymoma extending from C-2 to D-2.

of the column when the table is horizontal and will gravitate toward either extremity of the column depending upon the degree of inclination in either the Trendelenburg or erect position.

The indicator may be constructed by heating and bending ordinary glass tubing of 4 mm. diameter into a semicircle having a 3 cm. radius. After sealing a mercury droplet within the lumen, the tube may be enclosed in a small block of white pine or lucite which has been grooved for attachment to the spot-film device. The degree of tilt can then be calibrated and labeled by affixing lead numerals at appropriate points on the block, parallel to the long axis of the glass tube.

[1] Accepted for publication in June 1951. Presented on "Gadget Row" at the Thirty-seventh Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 2–7, 1951.

This simple inexpensive device has proved of great value in myelography and its use is planned in other radiographic examinations in which the inclination of the table should be known during interpretation of the film.

The Long Island College Hospital
Brooklyn 2, N. Y.

SUMARIO

Sencillo y Exacto Indicador de la Declividad

El sencillo accesorio descrito indica el grado de inclinación de la mesa en las películas mielográficas. Consiste en un tubo de vidrio que forma un semicírculo (3 cm. de radio), y en el cual va una gota de mercurio. Ambos extremos del tubo están cerrados al soplete, y el mismo va metido en un molde de madera o de alguna substancia plástica, el cual puede unirse al accesorio cuando se trata de tomar radiografías instantáneas. El tubo aparece en la pantalla roentgenoscópica y en la radiografía en forma de una columna semiopaca, dentro de la cual se divisa la sombra opaca de la gota de mercurio. Esta gravita hacia uno u otro extremo de la columna conforme al declive de la mesa. Numeros de plomo colocados en puntos apropiados indican el grado de la inclinación.

EDITORIAL

Joseph Clark Bell, M.D.

President of the Radiological Society of North America

Joseph Clark Bell, the new President of the Radiological Society of North America, was born Aug. 10, 1892, on a farm near the small town of Frostburg, Pennsylvania, some seventy-five miles north of Pittsburgh. His early schooling was in a country school where all grades, classified as 1st, 2nd, 3rd, 4th, and 5th readers, were taught. The number of pupils in the one room varied from seventy to ninety. After finishing the course there, Dr. Bell in 1907 entered the Indiana Normal School, in Indiana, Pennsylvania, where he spent two years. Subsequently, he taught a small country school of all grades for one year, after which his family moved from western Pennsylvania to Monmouth, Oregon. In Oregon, he again taught in a country school, near Salem, for one year. This school included all eight grades, and the highest enrollment at any one time was approximately eighty students.

Dr. Bell then entered the State Teachers College at Monmouth, from which he was graduated at the end of two years, to become a principal at Wendling, Oregon, a small lumber town in the foothills of the Cascade Mountains. There, in a four-room school, housing all of the grades and the first year of high school, Dr. Bell personally taught the 7th and 8th grades and the high school class. Wendling was a rather isolated community and its social life centered about the school. This must have been an interesting experience for Dr. Bell, since there was a large debating society and it was necessary for the "Professor," as he was called, to debate at least once every two months. Much to the delight of the community, he was always on the losing side.

This was in 1914, and Dr. Bell received ninety dollars a month for an eight-month term. At the end of the year, he was asked to return but the community found itself unable to pay the increase of ten dollars a month which he requested and he resigned his teaching position to enroll in the University of Oregon. He graduated at the end of two years, in June 1917.

Following his graduation, Dr. Bell was again employed as a principal, this time of the schools in Mill City, another lumber town. Shortly thereafter he volunteered for one of the field ambulance service units that was then being organized in Allentown, Pennsylvania. This unit was activated in September and became part of the Sanitary Train of the 91st Division. After spending approximately ten months in training at Camp Lewis, Washington, the unit went overseas in July 1918, at which time Dr. Bell had the rank of Technical Sergeant.

It is always of interest to learn just why one takes up the practice of medicine. Dr. Bell, although he was majoring in education, joined a class in zoology with a number of his premedical friends simply because he thought it would fit in well with other courses that he had taken. He soon realized that he was more interested in that subject than he had been in anything else, and it was then that he decided to enter medical school. Following his return from France, he entered the University of Oregon Medical School in September 1919. There he stayed for two years. He was admitted to Harvard Medical School in September 1921 and was graduated in June 1923.

As an interne, Dr. Bell served on the

Joseph Clark Bell, M.D.

President of the Radiological Society of North America

medical service of the Presbyterian Hospital of Columbia University under Dr. Walter Palmer, who later asked him to become an assistant resident in medicine. Dr. Bell accepted the appointment and would probably have been in medicine today had he enjoyed working in the laboratory. It was at this time that Dr. Ross Golden suggested that Dr. Bell become a resident in the Department of Radiology, a most satisfactory experience which lasted for one year.

In September 1925, Dr. Bell was invited into practice with two older radiologists in Louisville, Kentucky. He has remained in that community ever since, except for a period of three and one-half years during the Second World War when he served as a Lieutenant-Colonel in the U. S. Army, directing the Department of Radiology at the Percy Jones General Hospital, Battle Creek, Michigan.

On May 20, 1925, Dr. Bell married Miss Lorraine Seeley. This marriage has been an ideal partnership and the two have endeared themselves to all who know them. They have three children, two boys and a girl. Dr. Bell is what might be called a "family man." He takes time to enjoy his home and there makes welcome his friends, from such fields as history, journalism, art, and music, as well as medicine.

In Louisville Dr. Bell is the head of the Department of Radiology at the Norton Memorial Infirmary and an Associate Professor of Radiology in the University of Louisville Medical School. He is a member of many medical societies and in a number of them has served in an official capacity. He has written numerous papers on a variety of radiological subjects but his greatest forte is in the fields of the gastro-intestinal tract and the spinal cord.

Our President is a man who was born and reared in Pennsylvania, who received his college education in Oregon and his medical education in Oregon and Massachusetts, who served his traineeship in New York City, and has had his clinical practice in Kentucky. He brings to his new office a broad vision of the place of science in modern life. He has a true concept for values, hopes, and purposes. The Radiological Society of North America is in good hands.

EUGENE P. PENDERGRASS, M.D.

The Thirty-Seventh Annual Meeting

The Registration Committee reports for the Thirty-seventh Annual Meeting of the Radiological Society of North America 2,034 registrations and 150 women. Does that mean that women are something more or less than equivalent? To find the total registration does one count women members as 0.9, women guests as 0.8, wives as 0.5, daughters as 0.25, all others as 0.1? Certainly without the ladies the banquet would be a pretty dull affair, and they lend pulchritude to the distinction of the Carman lecture. So your reporter is going to give them full credit, and report the attendance as 2,184.

Because the floor space for meetings and exhibits was the same as it has been in previous years at the Palmer House, and because the circumference of many of the members has gradually been expanding, therefore be it explained that packing fraction was somewhat higher at this meeting than heretofore. As still larger attendance is to be anticipated at future meetings because young radiologists are being produced faster than the old are dying off, the oldsters are urged to reduce.

All nonsense to one side, it was a grand meeting. The program, the refresher courses, the commercial and scientific exhibits were all excellent. Everything went off with effortless smoothness, so far as those who had no responsibility could see, which, of course, indicates much preliminary work and forethought by the various committees. There must have been moments of frenzied tension, too, during the meeting, but the work and tension showed

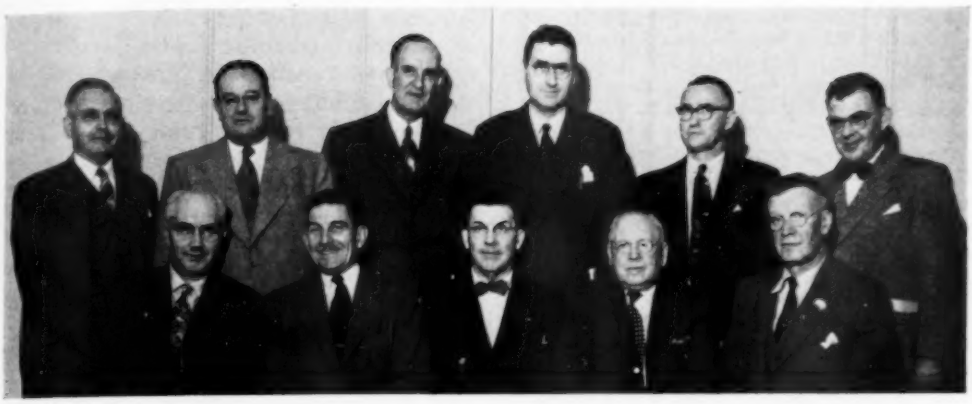
only in the smooth operation of the whole, for which we must all extend our sincere thanks to those responsible.

The only complaint heard was that there was too much to do. One could not attend all the refresher courses, hear all the papers, see all the exhibits, do one's Christmas shopping and see a couple of shows. Better thus, however, than not to have enough to do. There will always be some conflict in a meeting as important as this, lasting only one week. And besides, the shopping should have been done long ago. The one-platoon system is still better liked than the former one with two sections. Though it reduces the papers, it also greatly reduces the conflicts. It does work a hardship on those essayists who have to have their papers presented by title. But we can all read, and should pay special attention to those papers that we could not hear when they appear in the pages of RADIOLOGY.

The meeting was opened by a friendly welcome by Dr. Eugene T. McEnery, President-Elect of the Chicago Medical Society. Next came the President's address, by Dr. Bouslog, entitled "The Country Radiologist" but actually outlining the ideal relationship of the radiologist to other doctors. An enumeration of all the papers which followed would take too much space and would necessarily be inadequate. These papers will eventually be published and may be read in RADIOLOGY. Two symposia deserve special mention. The first one, given on Monday afternoon, was on Pediatrics. Dr. Lockwood was the moderator and, we suspect, arranged it. The other symposium, on Gastritis, given Wednesday afternoon, and presided over by Dr. Wasson, was the result of a cooperative study by various members of the Rocky Mountain Radiological Society. Symposia tend to be somewhat routine affairs because many of the papers are

Wide World Photo

Dr. George Pfahler, recipient of the Gold Medal of the Radiological Society of North America, with Dr. John S. Bouslog, Retiring President, and Dr. Joseph C. Bell, Incoming President.



Lawrence-Phillip Studios, Chicago

Newly Elected and Retiring Officers of the Radiological Society of North America

Left to right, back row: Dr. Clarence E. Hufford, Dr. Ivan M. Wooley, Dr. Howard P. Doub, Dr. Edward A. Petrie, Dr. Eugene P. Pendergrass, Dr. John H. Gilmore. Front row: Dr. H. Milton Berg, Dr. Joseph C. Bell, Dr. John S. Bouslog, Dr. Ira H. Lockwood, Dr. Donald S. Childs.

written for the symposium rather than because the writer has a real and personal inspiration to impart something of his own experience. Both of these, however, were excellent.

Tuesday evening, Robert S. Stone, M.D., Professor of Radiology in the University of California School of Medicine, San Francisco, gave the Carman Lecture: "The Concept of Maximum Permissible Exposure." Dr. Stone has never demonstrated his high scholarship more effectively nor has the choice of a Carman Lecturer been better vindicated. His lecture sounded as though he had read everything that has been written on radiation injuries since 1898 and had synthesized all these observations through his orderly, meticulous, and sceptical mind, producing *via* his cerebral churn, double cream. While he cannot give us the answer in r per unit of time, or erg per kilogram, or per cent of annual income, he has laid a secure foundation from which he and others will certainly make faster progress.

The Gold Medal was this year given to Dr. George E. Pfahler of Philadelphia. No award has been better earned, or more widely approved. This recognition of Dr. Pfahler's deserving has been long overdue. There are good reasons for this. Dr. Pfahler's contributions to radiology have been so fundamental and of such widespread influence that, like the pull of gravity, we have taken them for granted. His leadership in educating young radiologists and in establishing our specialty on a solid foundation has been so basic and exercised with such modesty that it has been accepted without remark. Like the keel of a mighty ship, steadying the ribs and furnishing the basic strength of the whole, so has George Pfahler stood to radiology. We are grateful to have such a man and we add honor to ourselves in bestowing upon him our highest honor.

In making the presentation President Bouslog outlined briefly some of the achievements that have marked Dr. Pfahler's long career, to which Dr. Pfahler replied with characteristic modesty. He said, in part:

> This is one of the great moments of my life. When Dr. Bouslog met me in Washington last September and told me that the Board of Directors had chosen me for this honor I was overwhelmed by surprise. I knew of no reason, and I do not yet know of any reason, why it should be conferred upon me.
>
> The greatest honor that can come to any man is that bestowed upon him by his colleagues. They know his weakness, they know his strength, and they are best able to judge as to his honesty. There-

fore, when a great Society like this confers an honor of this kind upon any man he has a right to feel very happy, as I do; as a matter of fact, I have always looked upon the fraternal spirit of the medical profession as one of the finest things in the world. I know nothing that equals it in any other profession.

Even before I had received any of the honors that have been bestowed upon me by the members of the profession, when I knew nothing of these societies, I said over and over again to my friends and colleagues that I would not trade the fraternal spirit and the ethics of the medical profession for a million dollars, and I repeat that today. I consider it one of the finest things in all the world.

This Society was organized in 1915, and the leaders of our profession built up an organization with the object of developing the younger men. All you need to do today is to look over the scientific program that is being presented, the scientific exhibits that are on display, and the journal which is so ably edited by Dr. Doub and his associates, to realize that we have contributed much to the advancement of medical science. We have a right to be proud.

The Radiological Society honored me in 1921, when my old schoolmate, Dr. Alden Williams, was its President, and I have been pleased with that honor during these thirty years. Now you have again honored me, this time by crowning me with the Gold Medal. Thank you very much.

A new slate of officers move in, in whom we can have complete confidence. Their capacity is so well known that they all were elected without dissent. Joseph C. Bell of Louisville, Ky., steps up into the hot seat of President. The President-Elect is Ira H. Lockwood of Kansas City, Mo.; First Vice-President, Harold G. Reineke of Cincinnati, Ohio; Second Vice-President, H. Milton Berg of Bismark, N. D.; Third Vice-President, Don R. Laing of Pasadena, Calif.; Secretary-Treasurer, none other than Donald S. Childs; Librarian, Howard P. Doub, Detroit, and last but not least, Member of the Board of Directors, C. Edgar "Spike" Virden of Kansas City, Mo.

Our congratulations go to our new officers. We promise them our co-operation. May they have a successful year and one without tribulation. When the Society meets again in Cincinnati, in 1952, may we all be present to share in the feast of education, inspiration, and renewed friendships.

SYDNEY J. HAWLEY, M.D.

The Refresher Courses

The refresher courses, given in conjunction with the Thirty-seventh Annual Meeting of the Society, enjoyed their usual popularity again this year. Thirty-seven courses were given, with a total registration of over 900 men from all parts of the country, the Canadian Provinces, Cuba, Central and South America, London, and Africa. Obviously this is the type of lecture the men want and it has become an integral part of the annual meeting.

We are indebted to the following instructors for their excellent presentations, and to the various members of the panels of the Film-Reading and Therapy Information sessions:

E. C. Baker, M.D.
Robert P. Ball, M.D.
J. Samuel Binkley, M.D.
Franz Buschke, M.D.
Ralph Caulk, M.D.
R. H. Chamberlain, M.D.
Lois C. Collins, M.D.
K. E. Corrigan, Ph.D.
A. A. deLorimier, M.D.
Carroll C. Dundon, M.D.
A. W. Erskine, M.D.
M. M. Figley, M.D.
Robert E. Fricke, M.D.
Milton Friedman, M.D.
L. Henry Garland, M.D.
Cesare Gianturco, M.D.
Ross Golden, M.D.
A. O. Hampton, M.D.
Roger A. Harvey, M.D.
F. J. Hodges, M.D.
John F. Holt, M.D.
Harold W. Jacox, M.D.
T. Leucutia, M.D.
Charles L. Martin, M.D.
E. P. Pendergrass, M.D.
Harold O. Peterson, M.D.
Ralph Phillips, M.D.
Edith H. Quimby, Sc.D.
Leo G. Rigler, M.D.
Wendell G. Scott, M.D.
David Shapiro, M.D.
E. C. Stafne, D.D.S.
I. Snapper, M.D.
Paul C. Swenson, M.D.
S. F. Thomas, M.D.
W. W. Wasson, M.D.
W. M. Whitehouse, M.D.
Bernard Widmann, M.D.

We also want to extend the thanks of the Radiological Society to the Local Refresher Course Committee appointed by the Chicago Roentgen Ray Society, headed by Dr. E. K. Lewis.

REFRESHER COURSE COMMITTEE
Paul C. Swenson, M.D.
Kenneth Davis, M.D.
C. Edgar Virden, M.D., *Chairman*

The Scientific Exhibits

The Scientific Exhibits section at the Thirty-seventh Annual Meeting of the Radiological Society of North America included an even larger number of exhibits than in 1950. Forty-nine exhibits, among which were seven individual showings in Gadget Row, were presented. An international flavor was added by presentations from Canada, Cuba, and England.

Comments from the viewers indicated that this section offered virtually a post-graduate study in itself. The range and quality of the exhibits are indicated by the difficulties of the secret committee for making the awards. They no longer felt that they could offer simply a series of prizes but provided separate awards in various categories.

Their report is as follows:

In the Field of Clinical Investigation:

1. Award of *Magna Cum Laude:* DRS. E. C. STAFNE, L. T. AUSTIN, AND S. A. LOVESTEDT, of Rochester, Minn., for their exhibit, "Dental Roentgenologic Manifestations of Systemic Disease."
2. Award of *Cum Laude:* DRS. STANLEY M. WYMAN AND WILLIAM R. EYLER, of Boston, Mass., "Sequestration of Lung."
3. Certificate of Merit:
   (1) Dr. GILBERT H. FLETCHER, ROBERT J. SHALEK, AND ARTHUR COLE, of Houston Texas, "Metal Ovoids with Differential Screening."
   (2) DRS. FRANK C. BINKLEY, GEORGE S. SHARP, AND JOHN E. WIRTH, of Pasadena, Calif., "Radiation Treatment of Cancer of the Tongue."
   (3) DR. A. JUSTIN WILLIAMS, of San Francisco, Calif., "Intra-Abdominal Hernia."
   (4) DRS. SAMUEL CANDEL AND DAVID E. EHRLICH, of Brooklyn, N. Y., "Venography of Upper Extremities, Neck and Chest During Valsalva Experiment."

In the Field of Fundamental Investigation:

1. Award of *Magna Cum Laude:* DRS. ALICE ETTINGER, CHARLES BERNSTEIN, AND FRANCIS WOODS, of Boston, Mass., "Bronchial Rearrangement and Bronchiectasis Following Pulmonary Resection."
2. Award of *Cum Laude:* DRS. K. E. CORRIGAN AND HENRIETTA CORRIGAN, of Detroit, Mich., "Tracer Studies in Children with Legg-Perthes Disease."
3. Certificate of Merit: L. D. MARINELLI AND DR. R. J. HASTERLIK, of Chicago, Ill., "Radium Toxicity."

Special Commendation for Cooperative Effort in Clinical Teaching:

1. The ROCKY MOUNTAIN RADIOLOGICAL SOCIETY, "Gastritis."
2. DRS. GWILYM S. LODWICK, WILLIAM L. THOMPSON, AND LENT C. JOHNSON, of Des Moines, Iowa, and Washington, D. C., "Malignant Primary Tumors of Bone."
3. DRS. AUBREY O. HAMPTON, M. FRIEDMAN, L. G. LEWIS, I. B. BRICK, H. I. AMORY, W. N. THOMAS, AND W. M. LEAVENWORTH, Washington, D. C., "Million Volt Irradiation of Normal Tissues, Late Effects and Tolerance Doses."

Marked interest was again shown in Gadget Row. Our Society offers something unique in this free market-place of minor devices and ideas. The prize award of "Chief Gadgeteer" went to DR. EARL MILLER of San Francisco for his device for restraining children during roentgen examination.

It is noted here, as well as in the awards committee report, that excellent co-operative efforts produced some exhibits of unusual quality; in these the results of the study of much material by many observers culminated in definitive valuable presentations.

The exhibits in addition to those listed above were as follows:

"Modified Body Section Radiography and Other Technics for Differential Definition and Magnification with Very Small (0.3 mm.) Focal Spot Tube," MARTIN S. ABEL, M.D., Oakland, Calif.

"The Diagnosis of Complete Transposition of the Great Vessels," HERBERT L. ABRAMS, M.D., AND HENRY S. KAPLAN, M.D., San Francisco, Calif.

"Experimental and Clinical Effects of Certain Substances Against Radiation Injury," ISIDORE ARONS, M.D., New York, N. Y., BORIS SOKOLOFF, M.D., AND WALTER B. EDDIE, M.D., Lakeland, Fla.

"The Gentle Art of Plagiarism," MELVIN ASPRAY, M.D., AND KENNETH E. GROSS, M.D., Spokane, Wash.

"Myelography in Spinal Cord Tumors," A. L. L BELL, M.D., J. BROWDER, M.D., J. ZWANGER, M.D., J. MAGOVERN, M.D., AND A. COOK, M.D., Brooklyn, N. Y.

"Beta Ray Treatment of Diseases of the Eye and Its Appendages," J. ERNEST BREED, M.D., Chicago.

"Mediastinal Tumors," JULES H. BROMBERG, M.D., EMANUEL KLOSK, M.D., HENRY A. BRODKIN, M.D., AND ARTHUR BERNSTEIN, M.D., Newark, N. J.

"The Use of Small Laboratory Animals in Medical Radiation Biology," F. ELLINGER, M.D., J. E. MORGAN, Commander, MSC, USN, AND F. W. CHAMBERS, JR., Commander, MSC, USN, Bethesda, Md.

"Detailed Roentgen Anatomy of the Orbits," LEWIS E. ETTER, M.D., Pittsburgh, Penna.

"The Treatment of Eye Lesions with the Sr^{90} Beta-Ray Applicator," H. L. FRIEDELL, M.D., C. I. THOMAS, M.D., AND J. S. KROHMER, M.A., Cleveland, Ohio.

"Diseases of the Breast," J. GERSHON-COHEN, M.D., AND HELEN INGLEBY, M.D., Philadelphia.

"Selective Pneumoencephalography," E. BRAVO-FERNANDEZ, M.D., AND R. A. GOMEZ-ZALDIVAR, M.D., Havana, Cuba.

"Comparison of X-Ray and Electron Beams from the 23 Mev Betatron," ROGER A. HARVEY, M.D., L. L. HAAS, M.D., AND J. S. LAUGHLIN, Ph.D., Chicago, Ill.

"X-Ray Visualization of the Intervertebral Disk," C. ROBERT HUGHES, M.D., R. E. WISE, M.D., AND W. J. GARDNER, M.D., Cleveland, Ohio, AND E. C. WEIFORD, M.D., Kansas City, Mo.

"New Contrast Media for Use in Examination of the Gastro-Intestinal Tract," HENRY H. JONES, M.D., AND H. S. KAPLAN, M.D., San Francisco.

"Sarcoidosis," GEORGE M. LANDAU, M.D., AND H. SCHORSCH, M.D., Chicago, Ill.

"Irradiation of Advanced Cancer Through a Grid," HIRSCH MARKS, M.D., New York, N. Y.

"Bony Metastases in Males," CHARLES ODERR, M.D., New Orleans, La.

"Diagnosis of Meningiomas," ANTON M. PANTONE, M.D., AND J. GARVIN, M.D., Chicago, Ill.

"Radiation Effects of $Iodine^{131}$ on Sheep," H. M. PARKER, M.Sc., H. A. KORNBERG, Ph.D., K. E. HERDE, M.S., AND L. K. BUSTAD, D.V.M., Richland, Wash.

"The Mediastinum in Infancy," S. PAUL PERRY, M.D., D. S. MOTSAY, M.D., AND J. T. LITTLETON, M.D., Sayre, Penna.

"70-mm. Motion Picture and Rapid Sequence Camera for Cinefluorography," G. H. S. RAMSEY M.D., J. S. WATSON, M.D., AND S. A. WEINBERG, M.D., Rochester, N. Y.

"Translucent Model as a Visual Aid in Teaching Radiation Therapy," RIEVA ROSH, M.D., AND O. COHEN, M.D., New York, N. Y.

"The Superior Vena Cava Compression Syndrome," BERNARD ROSWIT, M.D., G. KAPLAN, M.D., H. G. JACOBSON, M.D., AND J. GINNIS, M.D., Bronx, New York.

"Investigation of Cause of Lymphedema of the Upper Extremity after Radical Mastectomy," PETER E. RUSSO, M.D., J. M. PARKER, M.D., AND D. O. OSTERREICHER, M.D., Oklahoma City, Okla.

"Extraperitoneal Pneumography," HOWARD L. STEINBACH, M.D., DONALD SMITH, M.D., RICHARDS LYON, M.D., AND EARL R. MILLER, M.D., San Francisco, Calif.

"Horizontal Body Section Radiography," J. J. STEVENSON, M.D., London, England.

"Two Million Volt X-Ray Therapy Using Rotation," JOHN G. TRUMP, D.Sc., K. A. WRIGHT, B.A., AND W. W. EVANS, M.S., Cambridge, Mass., AND HUGH F. HARE, M.D., Boston, Mass.

"Granulomas of the Lung," LYLE A. WEED, M.D., AND L. B. WOOLNER, M.D., Rochester, Minn.

"Rapid Chest Photofluorography Utilizing the Land-Polaroid Process," H. STEPHEN WEENS, M.D., AND ALBERT A. RAYLE, JR., M.D., Atlanta, Ga.

"The Effect of Pancreatic Secretions on Small Intestinal Motility," JOHN F. WEIGEN, M.D., E. P. PENDERGRASS, M.D., T. MACHELLA, M.D., AND I. S. RAVDIN, M.D., Philadelphia, Penna.

"Mediastinal Tumors," IRVING WEISSMAN, M.D., AND J. M. CHRISTIE, M.D., Champaign, Ill.

"A Comparative Clinical Study of Two Cholecystographic Media," WALTER WHITEHOUSE, M.D., AND OWEN MARTIN, M.D., Ann Arbor, Mich.

"A Comparative Postmortem Radiological and Pathological Study of Children's Chests," C. F. WHITNEY, JR., M.D., AND F. W. WIGLESWORTH, M.D., Montreal, Canada.

"Irradiation Effects on the Growing Spine," MARTIN H. WITTENBORG, M.D., EDWARD B. D. NEUHAUSER, M.D., AND CARROLL Z. BERMAN, M.D., Boston, Mass.

"Blood Supply of the Human Lung," MANUEL O. ZARIQUIEY, M.D., AND C. E. TOBIN, M.D., Rochester, N. Y.

The Gadget Row exhibits were:

"Slide Rule for Radioactivity Computations," J. L. HERSON, Washington, D. C.

"Isodose Charts—Oldfielder Table Based on the Failla Projection Principle," HENRI LECLAIRE, M.D., St. Louis, Mo.

"Film Magnifier and Illuminator," HANS LEWIN, M.D., Topeka, Kan.

"Hydraulic Jack Fixation of Special Radiographic Stretcher," D. R. LIMBACH, M.D., Flint, Mich.

"Improved Applicator for the Manchester System," JESSHILL LOVE, M.D., Louisville, Ky.

"Device for Restraining Infants and Children During Roentgen Examinations," E. R. Miller, M.D., San Francisco, Calif.

"Simple Plane and Incline Indicator," JEROME ZWANGER, M.D., Brooklyn, N. Y.

The Scientific Exhibits Committee thanks the participants, individual and groups, for their contributions and cooperation.

IVAN J. MILLER, M.D., *Chairman*
Scientific Exhibits Committee

The Commercial Exhibits

The Commercial Exhibits section of the Thirty-seventh Annual Meeting of the Radiological Society of North America played its share in making this the best attended and most active meeting in the history of the society. Forty-one concerns displayed their various products. The activity in the commercial booths was eminently satisfactory to the exhibitors, who demonstrated to the radiologists many new products and new uses of their wares. The following descriptions of the various exhibits were provided by the exhibitors themselves, and should prove a useful source of reference:

AMPEREX ELECTRONIC CORPORATION (Brooklyn, N. Y.): The Amperex Electronic Corporation exhibited a selection of x-ray and electronic tubes of the latest types. Notable items were samples of radiography performed with the new "fractional focus" rotating anode tube, which incorporates a 0.3-mm. focal spot. The new direct magnification technic possible with this recently developed tube affords interesting possibilities in inspection of minute pathological changes in bones and joints.

AUTOMATIC SERIOGRAPH CORPORATION (College Park, Md.): The Sanchez-Perez Automatic Seriograph was demonstrated, in its application to cerebral angiography, angiocardiography, and kidney angiography. Standard cut films are used, and the automatic timer controls the rate of exposure, which ranges from two per second to one every two seconds. The Seriograph comes complete and ready for use, requiring a minimum of installation.

BAR-RAY PRODUCTS, INC. (Brooklyn, N. Y.): These manufacturers of x-ray and atomic energy protective materials exhibited many of their items. Three of these may be specially mentioned: (1) the "Archer" lead-glass fabric gown, which will be fabricated to provide protection for all areas of the body shown by film badge or other means to be receiving exposure in excess of the permissible amount; (2) a novel Add a Tank, a self-contained 68-degree water-tempered stainless steel film processing tank with two 5-gallon solution inserts and provision for doubled capacity by increase of insert size; (3) a revolutionary automatic positive temperature valve which will deliver 68-degree water with hot and cold supply ranging from 33 degrees to beyond the boiling point and is unaffected by variation in line pressures.

BUCK X-OGRAPH COMPANY (St. Louis, Mo.): The Buck X-Ograph exhibit consisted principally of roentgenograms made on the new Buck Red Label x-ray film, notable for their brilliant, free-from-fog quality. These new films will be ready for distribution in the near future.

COCA-COLA COMPANY (Atlanta, Ga.): The Coca-Cola booth was, as usual, a center of activity from the time the exhibit hall opened each morning until it closed for the day. Over 7,500 cokes were dispensed by the friendly attendants.

CORECO RESEARCH CORPORATION (New York, N Y.): The Coreco Company displayed its Coreco Automatic Color Camera, designed to photograph all surface areas of the body and such cavities as the mouth, throat, ear, nose, vagina, and rectum. The camera carries its own specially developed, fully color-corrected bulb and a mechanism for control of its color temperature and exposure within the camera itself. An automatic view finder synchronized with the automatic camera mechanism permits viewing until a fraction of a second before exposure. Provision is also made for automatic focusing.

DUNLEE CORPORATION (Chicago, Ill.): A complete line of radiographic x-ray tubes and valves was on display, including several new developments. Notable were a 500-ma. thoriated tungsten 40-watt filament valve completing a full range of such valves to parallel all pure tungsten filament types; a low-voltage, low-absorption type of x-ray tube, embodying a window of aluminum, beryllium, or other low absorption material mechanically sealed to the envelope in such a fashion as to make possible a permanently evacuated type of tube; hooded anode x-ray tubes with higher voltage ratings for a given tube size as compared to conventional open electrode types.

E. I. DU PONT DE NEMOURS & COMPANY (Wilmington, Del.): The Photo Products Department of the du Pont Company featured the wide processing and exposure latitude of Du Pont Type 508 x-ray film, which they demonstrated by four sets of roentgenograms:

1. One set was processed for five minutes at temperatures varying between 58 and 78° F. The film processed at 68° F. was superior; however, all the films possessed excellent diagnostic qualities.

2. Set two was developed at 68° F. for periods varying between one and ten minutes. The films processed at three and five minutes were superior, though the entire set possessed highly diagnostic properties.

3. Set three was made at 50 ma. with kilovoltages varying in 2 kv.p. increments between 74 and 84 kv.p. The resultant films illustrate that 5 kv.p. over- or underexposure does not result in serious loss of diagnostic quality.

4. The last set was made at 76 kv.p. with the milliamperage varied between 40 and 90 ma. A variation of 30 to 50 per cent in milliamperage did not seriously affect the end result.

EASTMAN KODAK COMPANY (Rochester, N. Y.): Eastman Kodak Company displayed the new Kodak

Microfile Machine and comprehensive system of radiographic microfilming; the new Kodak X-ray Processing Hanger, with completely redesigned film clips; a well integrated demonstration, with radiographs, of Kodak Blue Brand Medical X-ray Film, Kodak X-ray Intensifying Screens, and Kodak X-ray Processing Chemicals; and various cameras, including the new Kodak Signet Camera.

A model of a film clip of the new design, but nine times the size of an actual clip, and a demonstration of the stamping operations required in making the new clip, were interesting extra features.

As usual, many of the Company's most recent technical publications of interest in the fields of medical radiography and photography were available.

ELDORADO MINING & REFINING, LTD. (Ottawa, Canada): The Eldorado Cobalt-60 Beam Therapy Unit was the feature of this exhibit, with a pictorial display of the unit, mechanical details, and the first installation. Also shown was a model of the mercury shutter system which was, in part, fabricated from transparent plastic to enable demonstrations of the simplicity of operation and safety features.

EUREKA X-RAY TUBE CORPORATION (Chicago, Ill.): Eureka X-ray Tube Corporation displayed the latest developments in lightweight and middleweight rotating anode units.

The lightweight RA "53" unit weighs 16 lb. and is designed for self-rectified service using 100 ma. at 90 kv.p. for 2 3/4 seconds. The middleweight RA "51" unit weighs 23 1/2 lb. and has an exceptional self-rectified service rating of 100 ma. at 90 kv.p. for 4 1/4 seconds. The new SP-8 heavy-duty stationary anode unit with air-circulator for under-table fluoroscopic and spot-film service was also on display.

FAIRCHILD CAMERA & INSTRUMENT CORPORATION (Jamaica, N. Y.): Fairchild showed the new F-280 Roll Film Cassette for cerebral angiography and angiocardiography and several series of radiographs produced with its use. A prototype of an automatic sequencer for the Roll Film Cassette was also shown. The Roll Film 70-mm. Fluoro Record Camera and the Cut Film Fluoro Record Camera were exhibited, with the three Fairchild 70-mm. film viewers for reading photofluorographic chest films exposed in the 70-mm. cameras.

L. M. FORSYTH MANUFACTURING COMPANY (Chicago, Ill.): Two models of the Forsyth Harmonic-Drive Horizontal Stereocassette Changer were shown. One was a regular floor-base type, while the other utilized a new method of floor-to-wall mounting, providing increased convenience with a minimum of installation space. A specially constructed motor-driven, all belt drive mechanism is used to impart harmonic motion to the cassette carriage, which runs on special all-rubber tracks. The combination provides the utmost smoothness and reliability in operation. A built-in stationary grid, that slides behind one of the front protective panels when not in use, was also shown.

FRANKLIN X-RAY CORPORATION (Philadelphia, Penna.): The Franklin X-ray Corporation exhibited a floor-to-ceiling radiographic head stand, designed for ease of operation and perfect alignment in all phases of head radiography. All the accessories for this head stand were shown, namely the mobile platform chair, a specially designed head clamp, and a wall rack for convenient storage. Also demonstrated was the use of a roll film cassette with the head stand, making it a dual purpose unit. Angiograms of the head and heart could be taken by removing the Bucky diaphragm and sliding the roll film cassette into its place. Another new piece of equipment shown was a rotational therapy unit, equipped to accommodate a patient's chair and a table. A special feature of this unit is the automatic alignment of the patient, which can be accomplished while the treatment is being done. The unit is equipped with controlling devices operated from the control room, and with automatic angulation and positioning scales. It is mounted on large rubber-tired casters, and may be easily moved when it is desired to use the x-ray machine in the conventional manner. Still another feature of this unit is a variable speed motor for the rotational platform. The speed of this motor can also be regulated from a control room.

GENERAL ELECTRIC COMPANY (Milwaukee, Wis.): A new development in body-section radiography was announced by the X-ray Department of General Electric, making possible in the vertical position the same unusual clarity of detail which was demonstrated with the horizontal Ordograph. A series of upright sinus films attracted special attention. The conventional Waters view failed to demonstrate conclusively a fluid level which was shown in the upright Ordograph film. The horizontal Ordograph, shown at the meeting, was mounted on the Maxiscope or deluxe-type diagnostic x-ray apparatus.

GRUNE & STRATTON, INC. (New York, N. Y.): Of special interest in the Grune & Stratton book display was Volume I (Skeleton, Part I) of the English edition of Schinz' *Roentgen Diagnostics*, translated and edited under the supervision of Dr. James T. Case. This is to be followed by four additional volumes at eight-month intervals. Other books of special interest to radiologists were Storch's *Fundamentals of Clinical Fluoroscopy, with Essentials of Roentgen Interpretation* and Narath's *Renal Pelvis and Ureter*, containing over 200 pyelograms.

PAUL B. HOEBER, INC. (New York, N. Y.): Among the Hoeber books, particular attention was attracted by Dotter and Steinberg's *Angiocardiography*, just off the press. Presenting fundamental new information on the heart, this is one of the significant radiological texts of the year. Advance orders were taken for the Second Edition of *Physical Foundations of Radiology* by Quimby, Taylor, and Weatherwax, scheduled for Spring publication. Other distinguished volumes were Schwedel's *Clini-*

cal Roentgenology of the Heart, Ritvo's *Roentgen Diagnosis of the Skull*, Ferguson's *Roentgen Diagnosis of the Extremities and Spine* (2d edition), Kaplan's *Clinical Radiation Therapy* (2d edition), Coley's *Neoplasms of Bone*, and Reese's *Tumors of the Eye*.

INTERNATIONAL MEDICAL RESEARCH COMPANY (New York, N. Y.): Four therapy units were shown by the International Medical Research Company, as follows: (1) A mobile grenz ray therapy unit, which is air-cooled. (2) The same unit, wall mounted. (3) A mobile combination therapy unit which produces x-ray radiation up to 80 kv. continuous, contact, and grenz ray therapy. This unit has its own built-in water cooler for the tube, and is equipped with the automatic filter slide, which prevents the operator from exceeding 12 kv. without a filter. (4) The same, wall mounted.

KELLEY-KOETT MANUFACTURING COMPANY (Covington, Ky.): A representative display of the latest Keleket x-ray equipment included the Keleket Ceiling Mounted Tube-Crane, which affords greater facility of movement and optimum space-saving advantages, and the Keleket "C" Supertilt Table, with the latest "8 × 10" spot-film tunnel and new "parking" method for the latter. Also demonstrated were the Van De Graaff 2-million-volt generator and Rotational Therapy Chair, the Keleket 250-kv. Constant Potential Therapy Unit, including the control assuring dependable trouble-free operation, and Keleket's 500 Multicron Vertical Control, equipped with Thyr-X Timer, incorporating the features which afford "finger-tip" operation and true economy at its best.

LEA & FEBIGER (Philadelphia, Penna.): Lea & Febiger showed a number of recent additions to their list of books of value to radiologists: the new Second Edition of Eller and Eller's *Tumors of the Skin*, including much new material; Ritvo's *Chest X-Ray Diagnosis* and Shurtleff's *Children's Radiographic Technique*, both published in 1951; Davidoff and Epstein's *The Abnormal Pneumoencephalogram* and Davidoff and Dyke's *The Normal Encephalogram;* Holmes and Schulz's *Therapeutic Radiology;* Pohle's *Clinical Radiation Therapy;* Wesson's *Urologic Roentgenology*.

LIEBEL-FLARSHEIM COMPANY (Cincinnati, Ohio): In the Liebel-Flarsheim exhibit, the new and unusual Thyr-X Timer was the point of interest. In the Thyr-X, large thyratron tubes serve as the contactor in the x-ray generator's primary circuit. This provides extremely fast switching, allowing as many as 30 separate one-cycle exposures per second for x-ray movies. The timing head is a simple synchronous motor-driven timer with a continuous scale from 1/60 second to 14 seconds. All exposures, including fluoroscopy, are "impulse timed," giving full cycles with zero make and break. The timer is designed to relieve the x-ray transformer of the polarization and surge problems induced by usual contacting methods. The timing head of the Thyr-X is also available as a 1/20 second timer for use with a random contactor.

Several other Liebel-Flarsheim x-ray specialty items were exhibited, including the Bantam Bucky and the L-F Stationary X-ray Grids.

MACHLETT LABORATORIES, INC. (Springdale, Conn.): Machlett Laboratories displayed their complete line of rotating anode x-ray tubes, consisting of small lightweight units designed for 100-ma. self-rectified operation, which are designated as the Dynamax "20" series; more widely used rotating anode tubes for general radiography at voltages up to 100 kv.p., such as the Dynamax "25" and Dynamax "26," as well as the highest power rotating anode tube commercially available, the "Super Dynamax," rated for voltages up to 125 kv.p. In addition, versions of these tubes were shown, which have been especially designed to meet military applications. These are the Dynamax "30G," an over-table tube for general radiography, and an undertable tube designated as the Dynamax "36."

MALLINCKRODT CHEMICAL WORKS (St. Louis, Mo.): Mallinckrodt Chemical Works exhibited a number of x-ray diagnostic media, some of which are well known to radiologists, as barium sulfate, hippuran,* and iodeikon.* Chief emphasis, however, was given to a comparatively new medium, Urokon Sodium,* used for excretory urography and retrograde pyelography. X-ray films of the kidney, ureter, and bladder showed the results obtained with this material. Reprints and brochures covering the use of the media displayed were available.

F. MATTERN MANUFACTURING COMPANY (Chicago, Ill.): Mattern exhibited their new flexible and versatile deep therapy unit. This unit, with a capacity of 200 kv. constant potential, was of particular interest because of its unique design and compactness. Also exhibited was the new Mattern 4 & 1—8 × 10 spot-film device, believed to be the lightest weight device on the market. It is automatic and of the self-indexing type.

MICRO X-RAY RECORDER, INC. (Chicago, Ill.): Micro X-ray Recorder, Inc., has pioneered the manufacture of an entirely automatic machine for recording x-ray films, photographs, case histories, and all other types of material on a continuous 100-foot roll of 35-mm. film, automatically controlling densities and detail contained in the original. This will go far toward solving the hospital's problem of insufficient storage space for x-ray films for an adequate retention period. It offers the further advantage that all related information on a given case, including roentgenograms and photographs, may be recorded on a single film. The same unit can be utilized by medical educational institutions, making available to students reproductions of material relevant to the teaching program.

NORTH AMERICAN PHILIPS COMPANY (Mt. Vernon, N. Y.): The radiographic generator shown by

* T.M. Reg. U. S. Patent Office.

Philips is quite new to the profession. The system of control, in so far as selection of factors is concerned, provides for maximum energy loading for the x-ray tube focal spot that is chosen. In the electrical circuits a selected kilovoltage and prescribed exposure time result in the maximum milliampere value. The energy delivered to the focal spot is thus always at maximum and gives the shortest exposure time. This reduces movement unsharpness to a minimum. Other Philips items are a new flexible mounting and motor-driven hydraulic lift for the Fairchild Angio roll-film device, the Philips fractional focus 0.3 × 1.0-mm. rotating target x-ray tube, which still offers new possibilities for direct exposure enlargement, and the R.T. 200 Constant Potential Therapy Equipment, notable for its extreme flexibility, high output, and simplicity.

PAKO CORPORATION (Minneapolis, Minn.): Pako Circulation-Filtration and Automatic Chemical Replenishment Equipment was displayed, showing the advantages to be derived from its use—cleaner solution, longer solution life, and better results. The control of processing solution temperatures by Pakotemp was illustrated, and the effectiveness of a wetting bath containing Pako Wetting Agent in preparing films for drying was shown. With the latter agent film-drying time is reduced, wiping and sponging operations are eliminated, water spots and streaks are reduced, and the film is conditioned for storage. Also displayed were Pako Model 38 Filmtanx with Wall Pass for manual processing, Model 80 X-ray Filmtanx for fast developing of x-ray film at 80° F., and the Pako X-ray Dry-Cab, a new film-drying cabinet.

PICKER X-RAY CORPORATION (Cleveland, Ohio): Picker X-ray Corporation again displayed the Constellation Table, which was introduced to the profession over two years ago. The new Picker designed and built Military Field Unit, introduced this year, was also shown. Its portability and ease of assembly and disassembly without the use of tools aroused much interest. This unit is suitable for rough and rapid transportation, as well as air drops. The Picker Military Field Unit has been standardized by all branches of the Armed Services and is currently being delivered for field use.

The Picker Polaroid Processing Unit, whereby a dry, finished, ready-to-read radiograph is obtained in one minute without the use of solutions, water, or a darkroom, drew many interested spectators.

RADIOLOGY (Editorial Office, Detroit, Mich.): A map of the world against which were displayed the radiological journals of both hemispheres formed the exhibit of RADIOLOGY, the Radiological Society's official organ. Some eighteen journals representative of twelve countries were included. Copies of RADIOLOGY and other literature were to be had for the asking.

RADIUM CHEMICAL COMPANY, INC. (New York, N. Y.): Representatives of Radium Chemical Company, Inc., were in attendance to demonstrate the various standard and special clinical applicators for both radium and radon, as well as handling and protective equipment and accessories. The equipment and accessories on display included items that had been developed in the last forty years by the technical and mechanical departments of the Company in co-operation with the medical profession.

This Company offers to the medical profession radium in tubes, needles, cells, and plaques, as well as radon (radium emanation) in all-gold implants from New York and Chicago. Both radium and radon are available in a wide dosage range, to comply with clinically accepted technics.

SCHERING CORPORATION (Bloomfield, N. J.): Neo-Iopax, Schering's brand of urographic contrast medium, was featured at the exhibit, along with Priodax, Schering's brand of iodoalphionic acid. The latter is a safe, convenient, economical, and satisfactory agent for examining the gallbladder. Schering representatives were present to welcome members and guests and to answer inquiries concerning other products of their manufacture.

FRANK SCHOLZ X-RAY ENGINEERING SERVICE INC. (Boston, Mass.): The Scholz 6 in 1 spot-film devices for $6^1/_2 \times 8^1/_2$-inch and 8 × 10-inch films were shown, as well as a compact lightweight screen staging. Displayed for the first time was a photo tube pick-up for spot-film work with an optical scanning device. The advantages of this pick-up, which has no moving parts, are obvious. Also, it scans from the edge of the screen and does not obstruct the view, with the result that the fluoroscopist can actually see the entire spot film he is taking.

STANDARD X-RAY COMPANY (Chicago, Ill.): The Standard X-ray Company's exhibit contained outstanding examples of high-quality diagnostic and therapeutic x-ray apparatus. Featured was the Flexray 250-kv. Constant Potential Deep Therapy X-ray Unit, with Console Control Stand. This unit offers high roentgen output in quantity and quality and extreme flexibility and ease of operation.

A new 150-kv. Therapy Unit also attracted attention, as did the Miniature Film Apparatus and Diagnostic Control Panels of various capacities.

TRACERLAB, INC. (Boston, Mass.): Tracerlab featured its new packaged, rolling radio-isotope laboratory, consisting of a lead-shielded, high-sensitivity gamma detector, with pre-amplifier and positioning device, precision rate meter, and recorder. With this, in combination with Tracerlab's new radiochemical service, a hospital will have all of the equipment necessary for carrying out diagnostic and therapeutic work with radioactive iodine, phosphorus, and gold.

Also featured were the new radiocobalt units—the multicurie telecobalt beam therapy bomb and cobalt needles, provided in a wide range of lengths, activity, and point styles. For beta irradiation of the eye and various surface conditions, the Beta-ray

Applicator, containing radioactive strontium, was shown. For personnel monitoring, the popular Tracerlab film badge service has now been extended to provide an eight-position film survey, to measure radiation dosage at various positions on the body. A variety of scintillation and Geiger counters, scalers, survey instruments, pocket dosage meters, and other "hot lab" accessories were also on display.

WESTINGHOUSE ELECTRIC COMPANY (Pittsburgh, Penna.): The Westinghouse exhibit featured the newly developed Fluoradex diagnostic x-ray equipment and the Fluorex image amplifier.

The Fluoradex-180 is a fluoroscopic radiographic table which tilts from 90° vertical to a full 90° Trendelenburg and has such features as a new smooth table top, magnetic locks, and large travels of the fluoroscopic screen. The Fluoradex-60, a new radiographic tubestand, is designed for operation from the front of the x-ray table; it will accommodate the heaviest rotating anode x-ray tube, and will permit tube travel of 60 inches above the x-ray table, in a room with a ceiling height as low as 8 feet. The Fluoradex-500 has such extra features as completely automatic phototiming, special technic facilities, 1/120 second timing, with 8 per second recycling, tube protective circuits, and quiet operation.

The Fluorex was exhibited in a separate room, where an actual operating image amplifier tube was demonstrated.

Other items on exhibit included the Westex single tube unit, the Westline all-metal darkroom cabinets, accessories, and the Schonander head unit.

WINTHROP-STEARNS, INC. (New York, N. Y.). Winthrop-Stearns' featured products were Diodrast 35 per cent, 70 per cent Diodrast Compound, Skiodan 40 per cent, Skiodan 20 per cent, Skiodan Tabs and Skiodan Acacia. Other popular products were Phisoderm and Phisohex.

WOLF X-RAY PRODUCTS, INC. (New York, N. Y.): Wolf X-ray Products displayed their complete line of x-ray accessories. Featured in the exhibit were the Duplicoat x-ray protective aprons and protective gown; the new Wolf Identification Printer and Exposure Holders; the improved Wolf cassette, with its new spring hinge, which was cordially received by radiologists and technicians alike.

YEAR BOOK PUBLISHERS (Chicago, Ill.): The Year Book Publishers displayed a full line of books, featuring those of special interest to radiologists. The new 1951 *Year Book of Radiology*, edited by Hodges, Holt, Jacox, and Collins, includes 357 of the best articles from the past year's international special and general literature with 360 x-ray reproductions, drawings, charts, and graphs.

Other publications that attracted much interest were the six *Handbooks of Roentgen Diagnosis: The Skull, Sinuses and Mastoids; The Chest; The Gastro-Intestinal Tract; The Osseous System; The Arthropathies*, and *The Urinary Tract*. The enlarged second edition of Caffey's *Pediatric X-ray Diagnosis* and Volumes 1 and 2 of Glasser's *Medical Physics* gained their usual share of attention, as did Hodges, Lampe and Holt's *Radiology for Medical Students*.

T. J. WACHOWSKI, M.D., *Chairman*
Commercial Exhibits Committee

ANNOUNCEMENTS AND BOOK REVIEWS

GREATER MIAMI RADIOLOGICAL SOCIETY

New officers of the Greater Miami Radiological Society, elected at the December meeting, are Dr. John Ajac, President, and Dr. Maurice Greenfield, Ingraham Building, Miami, Secretary. Meetings are held monthly on the third Wednesday, at the Veterans Administration Building.

WASHINGTON STATE RADIOLOGICAL SOCIETY

The following officers of the Washington State Radiological Society were recently elected: President, Homer V. Hartzell, M.D.; Vice-President, John W. Settle, Jr., M.D.; Secretary-Treasurer, John N. Burkey, M.D., 555 Medical-Dental Building, Seattle 1. The Society meets on the fourth Monday of each month from September through May.

SOCIEDAD RADIOLÓGICA PANAMEÑA

The officers of the Sociedad Radiológica Panameña for the year 1952 are Dr. E. Zubieta, President; Dr. R. Sandoval, Vice-President; Dr. M. Carrizo, Treasurer; Dr. L. Arrieta Sánchez, Apartado No. 86, Panama, R. de P., Secretary; Drs. J. Flors and E. Buralndo, Deputy Officers.

ISTITUTO DI RADIOLOGIA DELL'UNIVERSITA, GENOA, ITALY

Plans are under way for a second International Course in Stratigraphy under the direction of Professor Alessandre Vallebona, to be held early in September 1952, at the Radiological Institute of the University of Genoa. The course will probably cover a period of eight to ten days. Because of the necessity of knowing in advance the approximate number of registrants, radiologists interested in attending are asked to communicate promptly with Dr. A. Piazza, Institute of Radiology of the University, St. Martins Hospital, Genoa, Italy.

AMERICAN COLLEGE OF CHEST PHYSICIANS

The Eighteenth Annual Meeting of the American College of Chest Physicians will be held at the Congress Hotel, Chicago, Ill., June 5–8, 1952. A scientific program covering all recent developments in the treatment of diseases of the heart and lungs is being arranged.

Examinations for Fellowship in The College will be held in Chicago on June 5, 1952. Candidates who wish to take these examinations should write the Executive Secretary, American College of Chest Physicians, 112 East Chestnut Street, Chicago 11, Ill.

NATIONAL BUREAU OF STANDARDS HANDBOOK 47

Rapid developments in nuclear physics and their practical applications have greatly increased the potential radiation hazards, while biological research has extended knowledge of dangers associated with ionizing radiations. Recently published by the National Bureau of Standards, NBS Handbook 47, *Recommendations of the International Commission on Radiological Protection and of the International Commission on Radiological Units, 1950*, presents recommendations adopted at the Sixth International Congress of Radiology. It also gives the best available data on permissible amounts of radioisotopes in the body and specifications of conditions for radiological treatment.

In adopting more rigid radiation safety standards, the Congress considered superficial injuries, effects on blood and blood-forming organs, induction of malignant tumors, cataract, obesity, impaired fertility, reduction of life span, and harmful genetic effects. Recommendations cover external and internal exposure to x-radiation and radium, working conditions, film storage precautions, and cumulative retention by the body of radioactive isotopes.

To minimize frequent revisions in old radiological units and standards made necessary by rapid changes in the high-energy radiation field, the Congress urged the future use of basic physical units, even though the delegates realized the present impracticality of making direct measurements in terms of these units. Handbook 47 contains suggestions made by the Congress concerning such units.

The Handbook should be ordered from the Government Printing Office, Washington 25, D. C. The price is 15 cents, and stamps are not acceptable. Foreign remittances must be in U. S. exchange and should include an additional one-third of the publication price to cover mailing costs.

COURSE IN ESSENTIAL PHYSICS IN RADIOLOGY

The University of Southern California Medical Extension Education is presenting a course in the Essential Physics in Radiology to be given from March 10 to May 26, 1952, covering x-ray, radium, and isotope radiation, and clinical applications of isotopes. This course will be offered Monday evenings from 8 to 10 P.M., the first six lectures to be presented at the Los Angeles County Hospital and the last six at the Cedars of Lebanon Hospital. The

lecturers are Robert E. Pugh, Jr., Physicist in Radiology, John Backus, Ph.D., Associate Professor of Physics, and Henry L. Jaffe, M.D., Associate Clinical Professor of Radiology (Therapeutic). The fee is $50.00.

Physicians interested in taking the course should make application to the University of Southern California, School of Medicine, Division of Medical Extension Education, 1200 North State St., Los Angeles, Barracks Building "A," Room 100.

Books Received

Books received are acknowledged under this heading, and such notice may be regarded as recognition of the courtesy of the sender. Reviews will be published in the interest of our readers and as space permits.

THE SKULL AND BRAIN ROENTGENOLOGICALLY CONSIDERED. By C. WADSWORTH SCHWARTZ, Ph.B., M.D., F.A.C.R., Associate Professor of Clinical Radiology, College of Physicians and Surgeons, Columbia University; Associate Clinical Professor of Radiology, College of Medicine, New York University; One-Time Director of Radiology, Neurological Institute of New York; Consultant to Presbyterian Hospital of New York, Hospital for Special Surgery of New York, New York City Hospital (Neurological Division); Associate Attending Radiologist, University Hospital, New York City, Mt. Vernon Hospital, Mt. Vernon, New York; Attending Radiologist, St. Agnes Hospital, White Plains, New York, and LOIS COWAN COLLINS, B.S., M.D., Associate Professor of Radiology, College of Physicians and Surgeons, Columbia University; Assistant Radiologist, Presbyterian Hospital, New York City; Associate Radiologist, New York Psychiatric Institute; Consultant, U. S. Marine Hospital, Staten Island, New York. A volume of 386 pages, with 335 figures. Published by Charles C Thomas, Springfield, Ill., 1951. Price $10.50.

THE MEASUREMENT OF RADIO ISOTOPES. By DENIS TAYLOR, M.Sc., Ph.D., M.I.E.E., F. Inst. P., Head of Electronics Division, Atomic Energy Research Establishment, Harwell. A volume of 118 pages, with 40 diagrams. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price $1.50.

PATHOLOGY OF THE FETUS AND THE NEWBORN. By EDITH L. POTTER, M.D., Ph.D., Associate Professor of Pathology, Department of Obstetrics and Gynecology, The University of Chicago; Pathologist, The Chicago Lying-in Hospital; Chief Pathologist, Chicago Department of Health. A volume of 574 pages, with 601 illustrations. Published by the Year Book Publishers, Inc., Chicago, 1952. Price $19.00.

ROENTGENOLOGIC DIAGNOSIS OF DISEASES OF BONES. By DAVID G. PUGH, Assistant Professor of Radiology, Mayo Foundation, Graduate School, University of Minnesota; Consultant, Section on Roentgenology, the Mayo Clinic. A volume of 316 pages, with 296 illustrations. Reprinted from Nelson's Loose-Leaf Diagnostic Roentgenology. Published by Thomas Nelson & Sons, New York, 1951. Price $5.00.

LA SPONDYLARTHRITE ANKYLOSANTE. CLINIQUE, RADIOLOGIE, ANATOMIE PATHOLOGIQUE, TRAITEMENT. By J. FORESTIER, Aix-les-Bains, F. JACQUELINE, Aix-les-Bains, and J. ROTES-QUEROL, Barcelona. A volume of 330 pages, with 143 figures. Published by Masson & Cie, Paris, 1951. Price 2650 fr.

DAS PHÄOCHROMOZYTOM. By PROF. DR. HEINRICH SACK, Chefarzt der Inneren Klinik der Städtischen Krankenanstalten Krefeld. A monograph of 94 pages, with 26 illustrations. Published by Georg Thieme, Stuttgart, 1951. Distributors for United States and Canada: Grune & Stratton, Inc., New York 16, N. Y.

EINFÜHRUNG IN DIE RÖNTGENOLOGIE. EIN LEHRBUCH FUR ÄRZTE UND STUDIERENDE. By G. F. HAENISCH, A. O. Prof. Dr. Med., Chefarzt I. R. am allgemeinen Krankenhaus, Barmbeck, Hamburg, and H. HOLTHUSEN, O. Ö. Prof. Dr. Med., Chefarzt am allgemeinen Krankenhaus, St. Georg, Hamburg, mit einem physikalischen-technischen Beitrag von A. LIECHTI, bearbeitet und ergänzt von Dr. W. FEHR, Hamburg. Fifth Edition. A volume of 522 pages, with 371 illustrations. Published by Georg Thieme, Stuttgart, 1951. Distributors for U. S. A. and Canada: Grune & Stratton, Inc., New York 16, N. Y.

LA MALATTIA SCLERODERMICA. By GUIDO BASSI. With a preface by PROF. GIOVANNI DI GUGLIELMO. A volume of 702 pages, with 185 figures. Istituto Editoriale Medico, Bologna, 1951.

Book Reviews

AN ATLAS OF NORMAL RADIOGRAPHIC ANATOMY. By ISADORE MESCHAN, M.A., M.D., Professor and Head of the Department of Radiology, University of Arkansas School of Medicine, with the Assistance of R. M. F. Farrer-Meschan, M.B., B.S. (Melbourne, Australia). A volume of 594 pages, with 362 figures comprising 1,044 illustrations. Published by W. B. Saunders Co., Philadelphia, Penna., 1951. Price $15.00.

In this new and very complete text the author has covered the roentgen anatomy of every part of the body. He has had in mind four types of reader: the teacher of anatomy, the teacher of radiology,

the teacher of clinical medicine, and the general practitioner. With a view to meeting the requirements of this rather diversified group, he has, in his own words, included: "(1) basic morbid anatomy as it is applicable to radiography; (2) the manner in which routine projections employed in radiography are obtained; (3) a concept of the film so obtained; (4) the anatomic parts best visualized on these views; (5) changes with growth and development; and (6) some of the more common variations of normal."

A typical treatment of the subject as applied to one area embraces illustrations of the bone taken from a standard textbook of anatomy, line drawings showing the development at different ages, sketches indicating the methods of positioning the patient for various views, roentgenograms taken in each position, and accompanying diagrammatic drawings with the anatomical points of interest indicated. Adequate explanatory text is included.

The technic of specialized procedures, such as pneumoarthrography of the knee, bronchography, etc., is described and illustrated, and nomograms for the measurement of various areas are included.

The illustrations in general are satisfactory, but in a few instances have lost some detail in reproduction. The general format is good, and the book is attractively bound. There is a comprehensive index.

The experienced radiologist will wish to add this book to his library for its wealth of facts on anatomy and development as these apply to radiology. To the student and beginner in radiology it will offer an unequaled foundation for future practice.

THE NORMAL CEREBRAL ANGIOGRAM. By ARTHUR ECKER, M.D., Ph.D. (Neurology), Surgical Neurologist, Syracuse, N. Y. A volume of 190 pages, with 140 figures. Published by Charles C Thomas, Springfield, Ill., 1951. Price $6.50.

Within the space of 190 pages Dr. Ecker presents a comprehensive account of the normal cerebral angiogram. The anatomical course of each artery and vein is fully described. All the normal variations are considered, and their limits are defined. The author's own technic of examination is given in detail. Such complications as occur are discussed, and the appropriate treatment is outlined. A short chapter on the artifacts produced by errors in technic is included. The index is easy to use.

Considered as a whole, this is an excellent book and one which should prove equally valuable to the beginner in cerebral angiography and to the experienced radiologist and neurosurgeon. The text is easily understood. Each of the 140 figures and x-ray reproductions is a fine example of the publisher's art. The author has chosen his illustrations well. The reviewer recommends it highly to all who are interested in cerebral angiography.

In Memoriam

ROBERT J. MAY, M.D.

1878–1951

Dr. Robert J. May, a former president of the Radiological Society of North America, died suddenly on Oct. 17, 1951. Doctor May was born Aug. 18, 1878, at Westlake, Ohio. He attended Baldwin-Wallace College and received his medical degree from the Cleveland College of Physicians and Surgeons. He was a charter member of the Cleveland Radiological Society and served as its president in 1932–33. Prior to this he had been active in the Radiological Society of North America and was president of that organization in 1930–31. He was a member of the American Roentgen Ray Society and a diplomate of the American Board of Radiology. He served as Chief of the X-Ray Department of St. Luke's Hospital, Cleveland, from 1914 to 1946.

Doctor May was an ardent sportsman, and each hunting and fishing season found him enthusiastically pursuing his hobby.

With his passing, Cleveland radiologists have lost a forceful leader, kindly man, and dear friend. His colleagues pause to pay their respects to his memory and accomplishments.

GEORGE L. SACKETT, M.D.

RADIOLOGICAL SOCIETIES: SECRETARIES AND MEETING DATES

Editor's Note: Secretaries of state and local radiological societies are requested to co-operate in keeping this section up-to-date by notifying the editor promptly of changes in officers and meeting dates.

RADIOLOGICAL SOCIETY OF NORTH AMERICA. *Secretary-Treasurer*, Donald S. Childs, M.D., 713 E. Genesee St., Syracuse 2, N. Y.

AMERICAN RADIUM SOCIETY. *Secretary*, John E. Wirth, M.D., 635 Herkimer St., Pasadena 1, Calif.

AMERICAN ROENTGEN RAY SOCIETY. *Secretary*, Barton R. Young, M.D., Germantown Hospital, Philadelphia 44, Penna.

AMERICAN COLLEGE OF RADIOLOGY. *Exec. Secretary*, William C. Stronach, 20 N. Wacker Dr., Chicago 6.

SECTION ON RADIOLOGY, A. M. A. *Secretary*, Paul C. Hodges, M.D., 950 East 59th St., Chicago.

Alabama

ALABAMA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, J. A. Meadows, Jr., M.D., Medical Arts Bldg., Birmingham 5.

Arizona

ARIZONA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, R. Lee Foster, M.D., 507 Professional Bldg., Phoenix. Annual meeting with State Medical Association.

Arkansas

ARKANSAS RADIOLOGICAL SOCIETY. *Secretary*, Fred Hames, M.D., Pine Bluff. Meets every three months and at meeting of State Medical Society.

California

CALIFORNIA MEDICAL ASSOCIATION, SECTION ON RADIOLOGY. *Secretary*, Sydney F. Thomas, M.D., Palo Alto Clinic, Palo Alto.

EAST BAY ROENTGEN SOCIETY. *Secretary*, Dan Tucker, M.D., 434 30th St., Oakland 9. Meets monthly, first Thursday, at Peralta Hospital.

LOS ANGELES RADIOLOGICAL SOCIETY. *Secretary*, John B. Hamilton, M.D., 210 N. Central Ave., Glendale 3. Meets monthly, second Wednesday, Los Angeles County Medical Association Bldg.

NORTHERN CALIFORNIA RADIOLOGICAL CLUB. *Secretary*, G. A. Fricker, Sacramento Co. Hospital, Sacramento 17. Meets at dinner last Monday of September, November, January, March, and May.

PACIFIC ROENTGEN SOCIETY. *Secretary*, L. Henry Garland, M.D., 450 Sutter St., San Francisco 8. Meets annually with State Medical Association.

SAN DIEGO ROENTGEN SOCIETY. *Secretary*, R. F. Niehaus, M.D., 1831 Fourth Ave., San Diego. Meets first Wednesday of each month.

SAN FRANCISCO RADIOLOGICAL SOCIETY. *Secretary*, I. J. Miller, M.D., 2680 Ocean Ave., San Francisco 27. Meets quarterly.

SOUTH BAY RADIOLOGICAL SOCIETY. *Secretary*, Ford Shepherd, M.D., 526 Soquel Ave., Santa Cruz. Meets monthly, second Wednesday.

X-RAY STUDY CLUB OF SAN FRANCISCO. *Secretary*, Merrell A. Sisson, M.D., 450 Sutter St., San Francisco 8. Meets third Thursday at 7:45 January to June at Stanford University Hospital, July to December at San Francisco Hospital.

Colorado

COLORADO RADIOLOGICAL SOCIETY. *Secretary*, Wendell P. Stampfli, M.D., 1933 Pearl St., Denver. Meets monthly, third Friday, at University of Colorado Medical Center or Denver Athletic Club.

Connecticut

CONNECTICUT STATE MEDICAL SOCIETY, SECTION ON RADIOLOGY. *Secretary*, Fred Zaff, M.D., 135 Whitney Ave., New Haven. Meets bimonthly, second Wednesday.

CONNECTICUT VALLEY RADIOLOGICAL SOCIETY. *Secretary*, Ellwood W. Godfrey, M.D., 1676 Boulevard, W. Hartford. Meets second Friday of October and April.

District of Columbia

RADIOLOGICAL SECTION, DISTRICT OF COLUMBIA MEDICAL SOCIETY. *Secretary*, U. V. Wilcox, M.D., 915 19th St., N.W., Washington 6. Meets third Thursday, January, March, May, and October, at 8:00 P.M., in Medical Society Library.

Florida

FLORIDA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Nelson T. Pearson, M.D., 1109 Huntington Bldg., Miami. Meets in April and in November.

GREATER MIAMI RADIOLOGICAL SOCIETY. *Secretary*, Maurice Greenfield, M.D., Ingraham Bldg., Miami. Meets monthly, third Wednesday, 8:00 P.M., Veterans Administration Bldg., Miami.

Georgia

ATLANTA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, J. Dudley King, M.D., 35 Linden Ave., N. E. Meets second Friday, September to May.

GEORGIA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Robert C. Pendergrass, M.D., Americus. Meets in November and at the annual meeting of the State Medical Association.

RICHMOND COUNTY RADIOLOGICAL SOCIETY. *Secretary*, Wm. F. Hamilton, Jr., M.D., University Hospital, Augusta.

Illinois

CHICAGO ROENTGEN SOCIETY. *Secretary*, Benjamin D. Braun, M.D., 6 N. Michigan Ave., Chicago 11. Meets at the University Club, second Thursday of October, November, January, February, March, and April at 8:00 P.M.

ILLINOIS RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Stephen L. Casper, M.D., Physicians and Surgeons Clinic, Quincy.

ILLINOIS STATE MEDICAL SOCIETY, SECTION ON RADIOLOGY. *Secretary*, Willard C. Smullen, M.D., St. Mary's Hospital, Decatur.

Indiana

INDIANA ROENTGEN SOCIETY. *Secretary-Treasurer*, William M. Loehr, M.D., 712 Hume-Mansur Bldg., Indianapolis 4. Annual meeting in May.

Iowa

IOWA X-RAY CLUB. *Secretary*, Arthur W. Erskine, M.D., 326 Higley Building, Cedar Rapids. Meets during annual session of State Medical Society.

Kansas

KANSAS RADIOLOGICAL SOCIETY. *Secretary*, Charles M. White, M.D., 3244 East Douglas, Wichita 8. Meets annually with State Medical Society.

Kentucky

KENTUCKY RADIOLOGICAL SOCIETY. *Secretary*, Everett L. Pirkey, M.D., Louisville General Hospital. Meets monthly, second Friday, at Seelbach Hotel, Louisville.

Louisiana

LOUISIANA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Johnson R. Anderson, M.D., No. Louisiana Sanitarium, Shreveport. Meets with State Medical Society.

ORLEANS PARISH RADIOLOGICAL SOCIETY. *Secretary*, Joseph V. Schlosser, M.D., Charity Hospital of Louisiana, New Orleans 13. Meets first Tuesday of each month.

SHREVEPORT RADIOLOGICAL CLUB. *Secretary*, Oscar O. Jones, M.D., 2622 Greenwood Road. Meets monthly September to May, third Wednesday.

Maine

MAINE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Clark F. Miller, M.D., Central Maine General Hospital, Lewiston.

Maryland

BALTIMORE CITY MEDICAL SOCIETY, RADIOLOGICAL SECTION. *Secretary-Treasurer*, Richard B. Hanchett, M.D., 705-6, Medical Arts Bldg., Baltimore 1. Meets third Tuesday, September to May.

Michigan

DETROIT X-RAY AND RADIUM SOCIETY. *Secretary*, James C. Cook, M.D., Harper Hospital, Detroit 1. Meets first Thursday, October to May, at Wayne County Medical Society club rooms.

Minnesota

MINNESOTA RADIOLOGICAL SOCIETY. *Secretary*, Leo A. Nash, M.D., 572 Lowry Medical Arts Bldg., St. Paul 2. Meets in Spring and Fall.

Mississippi

MISSISSIPPI RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, John W. Evans, M.D., 621 High St., Jackson 2, Miss. Meets monthly, third Tuesday, at 6:30 P.M., at the Rotisserie Restaurant, Jackson.

Missouri

RADIOLOGICAL SOCIETY OF GREATER KANSAS CITY. *Secretary*, Wm. M. Kitchen, M.D., 1010 Rialto Building, Kansas City 6, Mo. Meets last Friday of each month.

ST. LOUIS SOCIETY OF RADIOLOGISTS. *Secretary*, Donald S. Bottom, M.D., 510 S. Kingshighway Blvd. Meets on fourth Wednesday, October to May.

Nebraska

NEBRASKA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Russell W. Blanchard, M.D., 1216 Medical Arts Bldg., Omaha. Meets fourth Thursday of each month at 6 P.M. in Omaha or Lincoln.

New England

NEW ENGLAND ROENTGEN RAY SOCIETY. *Secretary*, L. L. Robbins, M.D., Massachusetts General Hospital, Boston 14. Meets monthly on third Friday, at the Harvard Club, Boston.

New Hampshire

NEW HAMPSHIRE ROENTGEN SOCIETY. *Secretary*, Albert C. Johnston, M.D., Elliot Community Hospital, Keene. Meets quarterly in Concord.

New Jersey

RADIOLOGICAL SOCIETY OF NEW JERSEY. *Secretary*, Nicholas G. Demy, M.D., 912 Prospect Ave., Plainfield. Meets at Atlantic City at time of State Medical Society and midwinter in Elizabeth.

New York

ASSOCIATED RADIOLOGISTS OF NEW YORK, INC. *Secretary*, William J. Francis, M.D., East Rockaway.

BROOKLYN ROENTGEN RAY SOCIETY. *Secretary*, J. Daversa, M.D., 603 Fourth Ave., Brooklyn. Meets fourth Tuesday, October to April.

BUFFALO RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Mario C. Gian, M.D., 610 Niagara St., Buffalo 1. Meets second Monday, October to May.

CENTRAL NEW YORK ROENTGEN SOCIETY. *Secretary*, Dwight V. Needham, M.D., 608 E. Genesee St., Syracuse 10. Meets in January, May, October.

KINGS COUNTY RADIOLOGICAL SOCIETY. *Secretary*, Marcus Wiener, M.D., 1430 48th St., Brooklyn 19. Meets fourth Thursday, October to May, at 8:45 P.M., Kings County Medical Bldg.

NEW YORK ROENTGEN SOCIETY. *Secretary*, Irving Schwartz, M.D., 45 E. 66th St., New York 21.

NORTHEASTERN NEW YORK RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, John F. Roach, M.D., Albany Hospital, Albany. Meets at University Club, Albany, second Wednesday, October, November, and March. Annual meeting in June.

ROCHESTER ROENTGEN-RAY SOCIETY. *Secretary-Treasurer*, George Gamsu, M.D., 191 S. Goodman St. Meets at Strong Memorial Hospital, last Monday of each month, September through May.

WESTCHESTER RADIOLOGICAL SOCIETY. *Secretary*, Walter J. Brown, M.D., Northern Westchester Hospital, Mount Kisco, N. Y. Meets third Tuesday of January and October and at other times as announced.

North Carolina

RADIOLOGICAL SOCIETY OF NORTH CAROLINA. *Secretary*, James E. Hemphill, M.D., Professional Bldg., Charlotte 2. Meets in May and October.

North Dakota

NORTH DAKOTA RADIOLOGICAL SOCIETY. *Secretary*, P. H. Woutat, M.D., 322 Demers Ave., Grand Forks.

Ohio

OHIO STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Willis S. Peck, M.D., 2001 Collingwood Ave., Toledo. Meets with State Medical Association.

CENTRAL OHIO RADIOLOGICAL SOCIETY. *Secretary*, Frank A. Riebel, M.D., 15 W. Goodale St., Columbus. Meets second Thursday, October, December, February, April, and June, 6:30 P.M., Columbus Athletic Club, Columbus.

CLEVELAND RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Mortimer Lubert, M.D., Heights Medical Center Bldg., Cleveland Heights 6. Meets at 6:45 P.M. on fourth Monday, October to April, inclusive.

GREATER CINCINNATI RADIOLOGICAL SOCIETY. *Secretary*, Lee S. Rosenberg, M.D., Jewish Hospital, Cincinnati 29. Meets first Monday, October through May.

MIAMI VALLEY RADIOLOGICAL SOCIETY. *Secretary*, Geo. A. Nicoll, M.D., Miami Valley Hospital, Dayton. Meets monthly, second Friday.

Oklahoma

OKLAHOMA STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, W. E. Brown, M.D., 21st and Xanthus, Tulsa 4. Meets in October, January, and May.

Oregon

OREGON RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, J. Richard Raines, M.D., Medical-Dental Bldg., Portland 5. Meets monthly, second Wednesday, October to June, at 8:00 P.M., University Club.

Pacific Northwest

PACIFIC NORTHWEST RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Sydney J. Hawley, M.D., 1320 Madison St., Seattle 4. Meets annually in May.

Pennsylvania

PENNSYLVANIA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, James M. Converse, M.D., 416 Pine St., Wlliamsport 8. Meets annually.

PHILADELPHIA ROENTGEN RAY SOCIETY. *Secretary*, George P. Keefer, M.D., American Oncologic Hospital, Philadelphia 4. Meets first Thursday of each month at 8:00 P.M., from October to May, in Thomson Hall, College of Physicians.

PITTSBURGH ROENTGEN SOCIETY. *Secretary-Treasurer*, Edwin J. Euphrat, M.D., 3500 Fifth Ave., Pittsburgh 13. Meets monthly, second Wednesday, at 6:30 P.M., October to May, at Webster Hall.

Rocky Mountain States

ROCKY MOUNTAIN RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Maurice D. Frazer, M.D., 1037 Stuart Bldg., Lincoln, Nebr.

South Carolina

SOUTH CAROLINA X-RAY SOCIETY. *Secretary-Treasurer*, Henry E. Plenge, M.D., 855 N. Church St., Spartanburg. Meets with State Medical Association in May.

South Dakota

RADIOLOGICAL SOCIETY OF SOUTH DAKOTA. *Secretary-Treasurer*, Marianne Wallis, M.D., 1200 E. Fifth Ave., Mitchell. Meets during annual meeting of State Medical Society.

Tennessee

MEMPHIS ROENTGEN CLUB. *Secretary*, John E. Whiteleather, M.D., 899 Madison Ave. Meets first Monday of each month at John Gaston Hospital.

TENNESSEE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, J. Marsh Frère, M.D., 707 Walnut St., Chattanooga. Meets annually with State Medical Society in April.

Texas

DALLAS-FORT WORTH ROENTGEN STUDY CLUB. Meets monthly, third Monday, in Dallas odd months, Fort Worth even months.

HOUSTON RADIOLOGICAL SOCIETY. *Secretary*, Frank M. Windrow, M.D., 1205 Hermann Professional Bldg.

TEXAS RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, R. P. O'Bannon, M.D., 650 Fifth Ave., Fort Worth.

Utah

UTAH STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Angus K. Wilson, M.D., 343 S. Main St., Salt Lake City. Meets third Wednesday, January, March, May, September, November.

Virginia

VIRGINIA RADIOLOGICAL SOCIETY. *Secretary*, P. B. Parsons, M.D., Norfolk General Hospital, Norfolk.

Washington

WASHINGTON STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, R. C. Kiltz, M.D., 705 Medical-Dental Bldg., Everett. Meets fourth Monday, October through May, at College Club, Seattle.

Wisconsin

MILWAUKEE ROENTGEN RAY SOCIETY. *Secretary-Treasurer*, Theodore J. Pfeffer, M.D., 839 N. Marshall St., Milwaukee 2. Meets monthly on second Monday at the University Club.

RADIOLOGICAL SECTION OF THE WISCONSIN STATE MEDICAL SOCIETY. *Secretary*, Abraham Melamed, M.D., 425 E. Wisconsin Ave., Milwaukee. Meets in May and with State Medical Society, September.

UNIVERSITY OF WISCONSIN RADIOLOGICAL CONFERENCE. Meets first and third Thursday at 4 P.M., September to May, Service Memorial Institute.

WISCONSIN RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Irving I. Cowan, M.D., 425 East Wisconsin Ave., Milwaukee 2.

CANADA

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ABSTRACTS OF CURRENT LITERATURE

ROENTGEN DIAGNOSIS

The Head and Neck

The Chest

The Digestive System

Hernia

The Musculoskeletal System

Obstetrics and Gynecology

The Genito-Urinary System

The Blood Vessels

ROENTGEN DIAGNOSIS

THE HEAD AND NECK

The Normal Cerebral Angiogram. Robert W. Curry and George G. Culbreth. Am. J. Roentgenol. **65**: 345–373, March 1951.

In a classic article which will undoubtedly be the point of reference for almost all future writing on the subject, the authors describe in detail the normal cerebral vessels and their angiographic appearance. As in other vascular systems, the courses and distributions of the cerebral vessels present considerable variation.

Physiological variations in the filling of the vessels are also common, due to marked differences in the size of the components of the circle of Willis and to altered pressure relationships produced by the force of the injection. These normal variations frequently simulate changes produced by pathologic processes and, unless they are continually borne in mind, mistakes in angiographic interpretation may easily be made.

A synopsis of an article such as this would be unfair, not to say impossible. It is strongly recommended reading for all radiologists, neurologists, neurosurgeons, and others who employ this diagnostic method.

Thirty-four roentgenograms; 5 drawings; 4 tables.

EVERETT L. PIRKEY, M.D.
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Technique of Pneumoencephalography in Children: Comparative Results with Air and Oxygen Injection. Louis Casamajor, Robert W. Laidlaw, and Philip J. Kozinn. J. Pediat. **38**: 463–467, April 1951.

Pneumoencephalography is a safe procedure. There were no deaths in 500 cases previously reported by the authors (J. A. M. A. **140**: 1329, 1949. Abst. in Radiology **55**: 136, 1950). The most serious complication is the occurrence of subdural fluid following the entrance of air into the subdural space. This was found in 10 to 15 per cent of a series of children reported by Smith and Crothers (Pediatrics **5**: 375, 1950. Abst. in Radiology **56**: 134, 1951). It is more likely to occur under two years of age. The authors have not seen this complication, possibly because they do few pneumoencephalograms on very young children, and possibly also because they prefer oxygen to air as the injected gas.

The present study concerns the reactions obtained after encephalography in 300 children. These included headache, vomiting, fever, and evidences of shock. Air was used in 200 of the cases, and oxygen in 100 cases. The age distribution of the two groups was similar, varying from a few months to fourteen years. The amount of gas used was comparatively the same in both groups. Only the type of gas and the preoperative and postoperative medication varied. It was found that the percentage of reactions and the duration of symptoms increased as the amount of air or oxygen was increased. It was also found that there were fewer post-encephalographic symptoms in patients receiving oxygen than in those in whom air was injected.

The authors believe that morphine leads to an increase in vomiting and respiratory difficulty following pneumoencephalography in children. For premedication they prefer to use atropine and codeine.

One photograph; 2 tables.

HOWARD L. STEINBACH, M.D.
University of California

Astrocytoma Grade III Associated with Profuse Subarachnoid Bleeding as Its First Manifestation. Case Report. Richard L. DeSaussure, Jr., Charles D. Scheibert, and Louis A. Hazouri. J. Neurosurg. **8**: 236–239, March 1951.

In a recent review of the American literature, Echols and Rehfeldt (J. Neurosurg. **7**: 280, 1950) were able to find 4 cases of profuse subarachnoid hemorrhage due to malignant brain tumor. The present authors report another case, which is unique in that the history was brief and cerebral neoplasm was not suspected.

The patient, a 27-year-old male, complained, when first seen, of a headache of thirty-six hours' duration, precipitated by slight trauma. He was stuporous but could be aroused. The pupils were pinpoint. Reflexes were hyperactive bilaterally, but no pathologic reflexes were obtained. A lumbar puncture yielded grossly bloody cerebrospinal fluid with an initial pressure of 270 mm. On the following day the Oppenheim sign was positive on the left.

About two weeks after the onset of the headache, angiography was carried out by the closed method. The right carotid angiogram was interpreted as being within normal limits; no evidence of aneurysm was noted. In the left carotid angiogram, a vascular anomaly was demonstrable in the left parietal area. In order to rule out tumor in the area, pneumoencephalography was performed. This revealed a filling defect in the anterior horn of the right lateral ventricle.

On craniotomy, a tumor was found in the inferior portion of the right frontal lobe, presumably invading the corpus callosum. The tumor was partially removed and the tip of the right frontal lobe amputated. Microscopic diagnosis was astrocytoma, grade III. Deep x-ray therapy was given postoperatively.

The tumor surrounded the anterior horn of the right lateral ventricle and is believed to have been responsible for the subarachnoid bleeding because of its location and vascularity. The transient Oppenheim reflex, which was the only pathologic reflex obtained, is more consistent with a right-sided lesion. The vascular abnormality on the left was not inspected, although it is realized that this may have contributed to the subarachnoid bleeding. It is thought that the tumor may have caused sufficient pressure to obstruct the venous flow from the vascular anomaly, even though the spinal fluid pressure was not consistently elevated. The slight trauma added to the presumed increase in venous pressure may have been enough to cause the leakage of blood into the subarachnoid space.

Angiography has its limitations, and vascular abnormalities are not invariably detected by this procedure. Air studies in patients with subarachnoid bleeding and negative arteriograms may reveal neoplasms or hematomas which would otherwise be overlooked.

Three roentgenograms.

Suprasellar (Rathke's Pouch) Cyst. Report of Unusual Case Simulating Successively Rheumatic Fever, Encephalitis, and Brain-Stem Tumor; Prolonged Postoperative Recovery and Development of Pubertas Precox. Alexander C. Johnson and John M. Meredith. J. Pediat. **38**: 380–386, March 1951.

A case of suprasellar (Rathke's pouch) cyst is reported, in which the initial history and neurologic find-

ings successively simulated (1) rheumatic fever, (2) encephalitis, and (3) brain-stem tumor. Aspiration of the cyst, inadvertently at first and intentionally later, not only afforded dramatic relief of pressure symptoms but, when combined with ventricular air replacement, permitted a striking roentgen demonstration of both the suprasellar cyst and the ventricular system. The patient remains well five and one-half years after initial surgical drainage of the cyst and x-ray therapy (details not given). A remarkable degree of pubertas precox developed postoperatively. It is thought that this disturbance is probably secondary to damage involving regulating neuroendocrine centers and pathways in the diencephalic area by various agents (inflammatory or neoplastic) and probably at various sites. The authors believe that the most likely explanation for the prolonged relief of symptoms following drainage of the cyst is the extensive radiation therapy which the child received, although possibly there is at least a slow leak of cyst contents into a lateral ventricle, thus decompressing the cyst.

One roentgenogram; 4 photographs.

Paradoxic Brain Abscess in Congenital Heart Disease. Ira Cohen, Philip S. Bergman, and Leonard Malis. J. Neurosurg. **8**: 225–231, March 1951.

Syndrome of Brain Abscess with Congenital Cardiac Disease. Report on a Case with Complete Recovery. Aaron J. Beller. J. Neurosurg. **8**: 239–243, March 1951.

Beller points out that the association of congenital heart disease and brain abscess is not a coincidence, but a definite syndrome, although little attention has been focused on this condition in the literature. A brain complication in a patient with congenital cardiac disease is generally interpreted as an embolism, and this explains why antemortem diagnosis and surgical intervention are uncommon.

In none of the cases reported has there been any clinical evidence of bacterial endocarditis or endarteritis. The source of infection in the brain must therefore be sought elsewhere. It is generally accepted that the venous-arterial shunt which is common to all cases of this syndrome explains the mechanism of the suppuration in the brain. "Paradoxic" infected emboli, which normally are filtered by the pulmonary capillaries, can reach the large circulation through the congenital defect and thus get into the brain. The primary focus of infection does not necessarily show clinical manifestations.

Cohen, with his associates, and Beller each report a successfully treated case of brain abscess associated with tetralogy of Fallot (the most common malformation of the heart in this syndrome). Beller states that in every case of cerebral complication in congenital cardiac disease air studies should be performed in order to rule out a space-occupying lesion. In most instances early recognition of the syndrome will permit surgical intervention with cure. Roentgenograms are reproduced with each case report.

To their own report, Cohen *et al.* add a review of the literature, summarizing 40 collected cases.

Reversible Cerebral Atrophy. William P. Williamson and Calvert J. Winter. J. Kansas M. Soc. **52**: 107–109, March 1951.

The authors report the case of a Negro child of three years and ten months, with almost total quadriplegia. Pneumoencephalography revealed diffuse enlargement of the entire ventricular system and an excess accumulation of air on the surface of the brain outlining shrunken gyri and widened sulci, believed to indicate either progressive degenerative disease or a post-encephalitic atrophy. No specific therapy was attempted, but one month later some clinical improvement was evident. This continued, and six and a half months after the original study the ventricles were definitely smaller and the subarachnoid markings on the surface of the brain were within normal limits. When last seen, several months later, the child exhibited only a minimal right hemiparesis. He walked almost normally, talked well, and had no complaints.

The pneumoencephalographic findings of moderately severe diffuse cerebral atrophy usually justify the conclusion that permanent brain damage has taken place. They are usually considered irreversible and indicative of an unfavorable prognosis.

Six roentgenograms.

Ossifying Fibroma of the Frontal Sinus. Simon Ball. Arch. Otolaryng. **53**: 460–465, April 1951.

Interest in the case of ossifying fibroma of the frontal sinus here reported was aroused by the difficulty in preoperative diagnosis. The patient complained of headaches over the past five years, limited for the most part to the left frontal and vertex regions. Three weeks prior to her first visit to the author she had noticed some fullness over the left frontal sinus. Examination of the nose disclosed no clinical evidence of sinus infection. Transillumination of the sinuses revealed a very dense left frontal sinus; all the other sinuses were clear. X-ray examination of the skull showed an area of minimal sclerosis interspersed with areas of bone destruction involving the anterior portion of the left frontal bone, which it was believed might represent a fairly localized osteomyelitis of either syphilitic or non-syphilitic origin. The possibility of a metastatic malignant lesion also had to be considered. There were minimal mucosal thickening of the left frontal, right ethmoid, and left maxillary sinuses and a moderate degree of mucosal thickening of the left ethmoid sinus. Roentgenograms of the chest and long bones were reported as normal.

At operation, the anterior wall of the frontal sinus presented a bluish, transparent appearance, giving the impression that there might be an angiomatous lesion behind it. The wall had been thinned as a result of pressure and could easily be removed with tissue forceps. A mass was found completely filling the sinus cavity and containing areas of both ivory-like and soft cancellous bone. The tumor was broader along the floor of the sinus, extending from the intersinus septum to the lateral limits of the sinus cavity, and was in intimate contact with the posterior wall, but there was no break in the bone and no dura was exposed. Complete removal was accomplished. The microscopic diagnosis was ossifying fibroma of the frontal bone.

Four months following the operation, there was no clinical or roentgen evidence of recurrence.

Five roentgenograms; 2 photographs; 2 photomicrographs.

Sclerosis of the Antrum. Samuel L. Fox and Edward A. Newell. Ann. Otol., Rhin. & Laryng. **60**: 61–74, March 1951.

The maxillary sinus is the most constant of the accessory sinuses and its absence—partial or complete—is

unusual. It may occur as a result of some disturbance of development or of pathologic changes involving a previously normal sinus.

The acquired osseous lesions reported as producing complete or partial bony obliteration of the maxillary sinus are Paget's disease of the skull, monostotic and polyostotic fibrous dysplasia, creeping periostitis of the facial and cranial bones, circumscribed osteitis, localized osteitis, obliterative sinusitis, von Recklinghausen's disease, acromegaly, syphilis, and xanthomatosis. The authors' purpose is to differentiate these acquired lesions from "sclerosis" of the maxillary sinus of developmental origin.

The main point of differentiation consists in the presence or absence of the outline of the bony margin of the maxillary sinus in the roentgenogram. In acquired osseous obliteration of the antrum, the outline of an adult antrum should be discernible on careful examination. In cases of developmental origin, if any outline is present, it will be that of a very small, rudimentary, infantile cavity.

A careful general medical examination, including roentgen studies of the skull and long bones, is essential in these cases in order to rule out generalized bone disease. An accurate history must be obtained to exclude chronic sinusitis as a possible cause. At operation, in cases of acquired osseous obliteration of the sinus, some of the mucous membrane lining of the original antrum should be found.

Two cases believed to be of developmental origin are reported. In each, roentgen examination revealed the antrum to be underdeveloped, with only a very small area of aeration superomedially. No bony margins of an adult maxillary sinus could be outlined, though the patients were thirty-one and forty-five years of age, respectively. Roentgen examination revealed similar changes in the ethmoid labyrinths, and the frontal and sphenoid cells were likewise underdeveloped. In each instance the condition was bilateral. No clinical or x-ray evidence of generalized osseous disease or sinus infection was found. Upon operation, in both cases, the anterior wall was found to be composed of a hard and thick type of cancellous bone. There was a dense diploic and sclerotic type of bone where the antral cavity should have been, with no mucous membrane.

The authors apply the term "sclerosis" to these cases of developmental osseous obliteration of the antrum, since a sclerotic or diploic type of bone is present instead of an antral cavity. They attribute the condition to acute or chronic inflammation of the mucosa of the antrum or disturbed endocrine function, especially of the pituitary, during the process of growth, to hereditary factors, or to trauma at birth or during infancy.

An "antrum" should not be created in these cases, when the condition is recognized.

Four roentgenograms. STEPHEN N. TAGER, M.D.
Evansville, Ind.

Internal Laryngocele. W. Franklin Keim and Robert G. Livingstone. Ann. Otol., Rhin. & Laryng. **60**: 39–50, March 1951.

The classification of laryngoceles as internal, external, and combined internal-external, depends on the relationship of the sac to the thyrohyoid membrane. If it is entirely within this boundary, it is internal; if it is present only in the neck at about the level of the hyoid bone, it is external; and if it can be observed both by laryngeal examination and by scrutiny of the neck, it is of the combined type. Conversion of the internal type into the combined probably takes place if the causative factors are continually exerted over a long period of time.

Impairment of the voice occurs most frequently as the first symptom. Cough may be a prominent complaint, and later in the course of the disease dyspnea may become the dominant symptom, sometimes even leading to asphyxia. This latter possibility and that of infection in the sac require that the condition be taken seriously and that proper treatment be instituted.

Seldom is the correct diagnosis of laryngocele made at the initial examination. Other more common tumors are usually suspected, especially cysts. X-ray studies will frequently establish the diagnosis by disclosing an ovoid area of radiolucency in the region of the clinical swelling. The internal type is more readily seen in a lateral view, partially overlying the vallecula, epiglottis, or larynx. The external variety shows up better in an anteroposterior exposure, as the radiolucent area is superimposed on the muscles of the neck. The anteroposterior view of the internal laryngocele may be unsatisfactory because of superimposition of the sac on the air column of the hypopharynx. Aspiration leading to immediate collapse of the sac is pathognomonic of laryngocele. If one obtains purulent or mucoid fluid, however, one may be misled into thinking that an infected laryngocele is only an abscess or an infected cyst.

Relief of urgent dyspnea may require puncture of the sac, a hazardous procedure without laryngoscopic observation, and imminent asphyxia may demand laryngeal intubation or immediate tracheostomy. In the presence of infection, only necessary measures such as relief of dyspnea should be employed. When operation may be safely undertaken, total extirpation of the sac is indicated.

Two cases of internal laryngocele with hoarseness and difficulty in breathing are presented. A surgical approach for removal of an internal laryngocele is also described and illustrated.

Nine illustrations, including 2 roentgenograms.
STEPHEN N. TAGER, M.D.
Evansville, Ind.

Tumor of Carotid Body Type Presumably Arising from the Glomus Jugularis. James L. Poppen and P. A. Riemenschneider. Arch. Otolaryng. **53**: 453–459, April 1951.

Two cases of tumor of the carotid body type presumably arising in the glomus jugularis are presented. This diagnosis should be considered for patients with a protracted history of increasing unilateral deafness, bloody discharge from the ear, and a vascular growth in the ear (a bruit was also noted in the authors' patients), especially if roentgenograms show destruction of the petrous ridge and mastoid cells or if biopsy is accompanied by profuse bleeding. One patient was given high-voltage x-ray therapy for what was thought to be an angioma, with no relief; however, temporary relief did occur following a reduction of the blood supply by ligation of the vertebral artery. The authors believe that surgical excision, when possible, is the treatment of choice, but that roentgen therapy might be worth while.

Five figures, including 2 roentgenograms.

THE CHEST

Roentgenographic Methods in Pulmonary Disease. Abraham G. Cohen and Abraham Geffen. Am. J. Med. **10**: 375–385, March 1951.

To overcome the limitations of the routine chest roentgenogram and to supplement the information derived from it, many additional roentgenologic technics have been developed. The authors group these as follows:

1. Positioning
   - Lateral and oblique views
   - Supine, Trendelenburg, and lateral decubitus positions
   - Tilting
   - Lordotic position (anteroposterior and postero-anterior view)
   - Stereoscopic views
2. Physiologic modifications
   - Expiration
   - Breathing at a constant intra-alveolar pressure
3. Penetration technics
   - Varying exposure
   - Potter-Bucky diaphragm
   - Body-section roentgenography
4. Use of contrast substances
   - Gas (pneumothorax; pneumoperitoneum; gas bubble in stomach)
   - Iodized oil (bronchography; fistulas)
   - Angiocardiography
   - Barium
5. Fluoroscopy

The application of these procedures to the study of pulmonary disease is discussed briefly.

Eleven roentgenograms.

Lipiodol vs. Water-Soluble Media for Bronchography. H. Métras, J. Charpin, M. Grégoire, and C. Gaillard. J. franç. méd. et chir. thorac. **5**: 246–248, 1951. (In French)

Exploration of Pulmonary Cavities by Water-Soluble Contrast Media for Bronchography. P. Oudet. Ibid., p. 304. (In French)

Métras and his associates have attempted to determine whether lipiodol or a water-soluble medium (umbradil, joduron B, diodone viscous) is preferable for routine bronchography.

Lipiodol presents certain inconveniences. Since it is not completely water-soluble, it does not enter small bronchi where mucous and other secretions are abundant. Considerable time may be required to remove it from the lung, and its retention may interfere with the interpretation of subsequent roentgenograms. It is possible, also, that retained lipiodol may further diminish pulmonary function in patients in whom this is already mediocre. Very rarely granulomas surrounding drops of lipiodol have been encountered at autopsy. On the other hand, lipiodol is relatively easy to use, the resultant radiographic image is good, one may study almost the entire bronchial tree, and cavities such as those caused by abscesses, cysts, etc., may be filled. Use of the medium is contraindicated in the presence of functional insufficiency of pulmonary or cardiac origin, in severe emphysema (in which elimination of lipiodol is difficult), for examination prior to major thoracic surgery, and where repeated studies are required.

The chief advantage of the water-soluble media lies in their rapid elimination, though in one respect this is also a disadvantage, in that the rapid absorption through the bronchial mucosa provokes bronchial spasm. The high viscosity of the product used in France does not permit exploration of the very small bronchi, and it is impossible to do bilateral bronchography at a single session. The viscosity, added to the spasm produced by rapid absorption, prevents impregnation of almost any type of cavity. It is difficult, furthermore, to do bronchography in a young infant with water-soluble material. Even in the cases of emphysema where lipiodol is relatively contraindicated, it is dangerous to substitute a water-soluble substance because of the irritation provoked and the immediate side-effects which may be encountered.

The authors conclude that for routine bronchography they definitely prefer lipiodol to the water-soluble substances. In the discussion Benda stated that the Swedish and Swiss products had given the same impression as the French. Bernard stated that the pediatricians had renounced water-soluble contrast substances because of the increased degree of anesthesia necessary. He also emphasized that postural drainage greatly improved the elimination of lipiodol.

In reference to the observations of Métras and his associates, Oudet points out that, if the local anesthesia of the bronchial tree is adequate, many pulmonary cavities may be filled with a water-soluble contrast medium. The opacity is not very intense, however, and visualization may be poor in areas where there is already considerable pulmonary opacity. When lipiodol is used, the neighboring alveoli are filled, and this somewhat obscures the radiologic picture of the cavitation. This does not usually occur with the use of water-soluble contrast materials.

Oudet concludes his brief comment by stating that the exploration of pulmonary cavities is a major indication for the use of water-soluble contrast materials in bronchography.

CHARLES M. NICE, M.D.
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A Stereoscopic Roentgen Study Regarding the Influence of Goiter on the Anatomy and Topography of the Tracheobronchial Tree. H. Brückner. Fortschr. a. d. Geb. d. Röntgenstrahlen **74**: 329–336, March 1951. (In German)

The author reports an investigation of 28 patients with goiter varying from the size of a walnut to a fist, the majority being in women between thirty and forty years of age. X-ray studies were made with the patient recumbent. Films were exposed in inspiration and expiration, frequently stereoscopically, and control films were made eight days after operation.

The author mentions a special stereoscopic apparatus by which accurate measurements may be made and finer details observed than on the usual conventional type of film. After description of the normal appearance and variations of the trachea, he states that displacement may be easier laterally, parallel to the midline or slanting from the left above to the right below. In the latter event, the goiter displaces the trachea to the left in the upper portion and the aortic arch exerts pressure causing deviation to the right in the lower portion. The diffuse parenchymatous goiter often causes pressure and stenosis from both sides. The nodular goiter causes greater deviation in position, displacing the trachea to the left but not, in any observed instance, to

the right. When compression from the right side occurs, there is definite molding; pressure from the left causes very little compression but more displacement. After operation, the return to normal is usually rapid and complete. The laryngeal structures are, in some instances, displaced upward and, if the growth is asymmetrical, laterally. The level of the bifurcation is changed very little if any, since the trachea has a certain amount of elasticity.

The author tabulates observed changes in the length of the trachea: in the normal patient, in inspiration 14.4 cm., in expiration 12.8 cm.; in the goiter patient before operation, in inspiration 14.3 cm., in expiration 13.8 cm.; in the goiter patient after operation, in inspiration 14.5 cm., in expiration 13.1 cm. This indicates that there is a virtual return to normal postoperatively.

With the special stereoscopic apparatus, slight changes in the diameter of the trachea and main upper bronchi may be noted, but these are not of any significant degree. A measurable change in the bifurcation angle was noted; in the normal subject, on inspiration, it averaged 80 degrees, on expiration 87 degrees. In the goiter patient, the figure for inspiration averaged 75.7 degrees and the expiration figure 84.2 degrees.

[Although the above observations appear rather academic for practical clinical use, they call attention to changes which may be important not only in goiter cases but in other types of tracheal displacement due to mediastinal disease.—E.W.S.]

Five illustrations.

E. W. SPACKMAN, M.D.
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Anomalous Lobe of Lung Arising from the Esophagus. Stephen L. Gans and Willis J. Potts. J. Thoracic Surg. **21**: 313–318, March 1951.

A girl of five months had been coughing practically since birth. She had gained less than 2 pounds in weight and did not tolerate solid foods. Dullness and absence of breath sounds were found over the left upper chest. Multiple, cyst-like translucent areas in the left upper lung field were seen on the chest film.

Bronchoscopy revealed compressed left lower and upper lobe bronchi. There was little air exchange in the left lower lobe and none in the left upper. Esophagoscopy demonstrated a fistula at the level of the tracheal bifurcation. Pus dropped into the esophagus from the fistula.

Surgical exploration revealed a resectable ectopic lung arising from the esophagus and totally involved by aspiration pneumonia. The left main bronchus was firmly adherent to the inferior margin of the atelectatic mass of anomalous lung.

The lungs and foregut have a common embryologic origin, and in early fetal life the esophagus and trachea are one structure, which would explain this and similar anomalies.

Three roentgenograms; 1 photograph.

DONALD DEF. BAUER, M.D.
St. Paul, Minn.

Bronchogenic Carcinoma as a Differential Diagnostic Problem in Pulmonary Disease. II. Carcinoma Arising from Major Bronchi Complicated by Secondary Infection. John H. Moyer and Alfred J. Ackerman. Am. Rev. Tuberc. **63**: 255–274, March 1951.

When bronchial obstruction or stenosis produced by a neoplasm is accompanied by infection, as is not infrequently the case, the inflammatory disease may alter the clinical and roentgenographic manifestations of the tumor. As a result, a new group of differential diagnostic possibilities has to be considered. Bronchiectasis is observed in about 20 per cent of patients with bronchogenic carcinoma, and it may mask the neoplastic disease for some time. Acute pneumonic-like lesions may result from partial occlusion of a bronchus, and with response of these lesions to antibiotics, plus decrease in the amount of obstruction which may follow necrosis of the tumor, with clearing of atelectasis and the inflammatory process, the underlying neoplasm may escape detection.

Unresolved pneumonia may closely simulate inflammatory disease associated with endobronchial tumor because the former may respond so slowly to treatment as to raise a strong suspicion of neoplasm. On the other hand, diffusely infiltrating tumors may simulate pneumonic consolidation and only when resolution is long delayed is the presence of a neoplasm ascertained. Tuberculosis may occasionally present a difficult differential diagnostic problem, particularly when tubercle bacilli are not demonstrated readily. The presence of tumor may be obscured for some time by tuberculous disease.

Occasionally changes secondary to bronchogenic carcinoma may be simulated by infarcts, particularly when the history is not reliable. The roentgen sign of a decrease in volume in cases of patchy atelectasis may be altered by accompanying inflammatory disease so that these areas may resemble infarcts, and the two conditions may, of course, coexist.

Cavitation associated with bronchogenic carcinoma may be the result of complicating inflammatory disease or of necrosis within the tumor itself. In many instances the roentgenographic features of neoplastic cavities are sufficiently distinct to permit a correct diagnosis. In other instances, however, recognition of the underlying disease depends on the clinical course and upon special studies, laminagraphy being of particular value in demonstrating alterations in bronchial size and thickness and irregularity of the wall of the cavity in cases of bronchogenic carcinoma.

Thirteen cases are presented, along with roentgenograms, to illustrate the diagnostic problems discussed. The role of body-section roentgenography and bronchography as diagnostic aids is emphasized.

Twenty-six roentgenograms.

JOHN H. JUHL, M.D.
University of Wisconsin

Bronchogenic Carcinomas as a Differential Diagnostic Problem in Pulmonary Disease. III. Peripheral Type: Carcinoma Arising from the Minor Bronchi and Bronchioles. John H. Moyer and Alfred J. Ackerman. Am. Rev. Tuberc. **63**: 399–416, April 1951.

Peripheral circumscribed bronchogenic carcinoma has been thought to be somewhat more malignant than central types, probably due to its late recognition in the absence of associated inflammatory and obstructive changes. Because of the late pulmonary manifestations, these tumors not infrequently are found in a search for the cause of remote metastases. The authors feel that patients with circumscribed peripheral lung shadows should be explored. This is particularly indicated if studies do not reveal any possible inflammatory or vascular cause for the lesion. Body-section roentgenography is often useful in differentiating neoplastic

from inflammatory disease but many times, all methods fail to reveal the nature of the lesion.

Case histories and roentgenograms are presented which show peripheral nodules representing bronchogenic carcinoma, arteriovenous fistula, coccidioidomycosis, tuberculoma, bronchial adenoma, metastatic nodule (solitary), and a mesenchymoma located in the interlobar fissure. The only lesion in the group which contained calcium was the coccidioidomycotic nodule.

"Alveolar-cell" carcinoma or "carcinomatous pneumonia" extends within the respiratory passages to the alveoli, gradually filling the segments of the lung until complete consolidation of a lobe has occurred as a result of the neoplastic invasion. A closely allied condition is "pulmonary adenomatosis," which presents a benign histologic picture but a malignant clinical course. This condition is now thought to be a neoplasm, characterized by proliferation of columnar epithelial cells within the alveoli, eventually becoming papillary. The authors feel that it is a form of bronchogenic carcinoma which displays benign histopathologic manifestations.

Pleural effusion, while it is more frequently seen with peripheral bronchogenic carcinoma, may be present in any type. The fluid makes roentgen diagnosis of the underlying condition difficult at times. Secondary involvement of the mediastinum, with resulting vena caval obstruction, paralysis of the diaphragm, etc., is easy to recognize when the primary tumor is readily seen, but the cause for these findings may be quite obscure when the tumor cannot be visualized.

Metastatic lesions may occur virtually simultaneously with the primary bronchial tumor, so that diagnosis of "early" carcinoma is made only under optimum circumstances, in some cases. It is necessary, therefore, that close cooperation be maintained between the clinician, radiologist, bronchoscopist, pathologist, and surgeon to increase diagnostic efficiency.

Nineteen roentgenograms. JOHN H. JUHL, M.D.
University of Wisconsin

Bronchial Carcinoma on a Background of Chronic Inflammation. Bernhard Mangelsdorff. Fortschr. a. d. Geb. d. Röntgenstrahlen **74**: 336–342, March 1951. (In German)

The possibility of the origin of primary bronchogenic carcinoma within an area of chronic lung disease has been considered by numerous authors. It is believed that bronchiectasis, abscess, chronic areas of pneumonitis, etc., over a long period of time, very probably lead to metaplasia of the bronchial epithelium, resulting in malignant change.

The author had occasion to follow a case of localized lung infection with a history of approximately ten years in which, under conservative treatment, carcinoma arose. In 1939 the patient, a 54-year-old man, reported to the hospital with fever, cyanosis, cough, and dyspnea. Fluoroscopy and roentgenographic studies revealed an irregular mottled shadow in the left mid lung field, with a transparent rounded area within. The diagnosis was lung abscess, probably in the under portion of the left upper lobe. Improvement followed conservative treatment. Later, a mottled shadow appeared, projecting outward from the upper portion of the right hilus. This was also treated conservatively. In 1950 by tomography and bronchography a definite stenosis of the pectoral branch of the right main upper lobe bronchus was noted, with peripheral hypertrophic cylindrical bronchiectasis. The patient died in the same year, and autopsy showed old bronchiectasis, chronic bronchitis with pneumonitic infiltration, edema, and definite bronchogenic carcinoma with small metastatic areas in the hilar lymph nodes.

The above findings are considered as reasonable proof that the underlying chronic inflammatory lung condition formed the basis for development of the malignant lesion and that such chronic infections should be considered potentially precancerous.

Eight roentgenograms. E. W. SPACKMAN, M.D.
Fort Worth, Texas

Pulmonary Adenomatosis. Report of Two Cases. Edwin W. Peterson and John D. Houghton. New England J. Med. **244**: 429–433, March 22, 1951.

Two cases of pulmonary adenomatosis are reported with a foreword declining any wish to enter the controversy concerning the origin of the neoplasm.

The first patient, a 59-year-old sheet-metal worker, had lung symptoms originating in 1945. He was seen in 1947, at which time the chest roentgenograms showed changes slightly more advanced than were reported in prior studies. The left hemidiaphragm was elevated posteriorly and several circumscribed areas of infiltration were seen in the region of the lingula. Segmental resection was done and the patient was alive and free of all signs of the disease two and a half years later.

The second patient, a 56-year-old retired mounted policeman, was seen in 1947. From the onset extensive pleural and parenchymal changes were seen on the right side. Nitrogen mustard and streptomycin were not beneficial. A second admission in 1948 showed rapid progressive physical deterioration of the patient. A film obtained two weeks after this admission, ten days before death, demonstrated complete collapse of the right lung, with a large pneumothorax. Necropsy showed limitation of disease to the right lung without penetration of the thickened pleura. Advanced fibrosis was also present.

These two examples of a relatively uncommon neoplasm lead the authors to conjecture about the feasibility of greater use of surgery despite all prior emphasis on multicentric origin of this disease.

Three roentgenograms; 2 photomicrographs; 1 photograph. JOSEPH P. TOMSULA, M.D.
Baton Rouge, La.

Solitary Lung Tumors. Donald B. Effler. Am. Rev. Tuberc. **63**: 252–254, March 1951.

Sixteen asymptomatic solitary lung tumors were surgically removed during a one-year period at the Cleveland Clinic. The tumors were discovered either in mass surveys or during investigation of an unrelated complaint. There was no operative mortality, and only 2 patients had minor complications. Of the group, only 2 had lesions which appeared to be incapable of producing damage. Six of the tumors were bronchogenic carcinoma, and 1 was a metastatic hypernephroma. One hamartoma was found, and the rest were localized tuberculous lesions of various degrees of chronicity.

Because of the high incidence of malignancy and of potentially dangerous inflammatory lesions (tuberculous), procrastination is not justified in an attempt to follow the progress of this type of lesion. Exploratory thoracotomy and removal of the tumor can be accomplished with little mortality and should be done, the

author believes, in view of the uncertainty of preoperative diagnosis.

One table.

JOHN H. JUHL, M.D.
University of Wisconsin

Intrathoracic Axillary Neurinoma. P. Pruvost, R. Sauvage, and R. Depierre. J. franç. méd. et chir. thorac. **5**: 140–143, 1951. (In French)

Solitary neurinomas (neurofibromas) are usually seen in the posterior mediastinum. A case is presented of a 50-year-old man who was found during a routine roentgen survey to have a pleuritic reaction in the right base. A few months later, as the pleurisy subsided, a rounded, well-demarcated density was noted near the right axillary region. The tumor grew rapidly, but the patient had no symptoms. No rib changes were noted. Needle puncture yielded no fluid. Surgical excision revealed a neurinoma.

Three roentgenograms; 1 photomicrograph.

CHARLES M. NICE, M.D.
University of Minnesota

Löffler's Syndrome. Transient Pulmonary Infiltration with Eosinophilia. Charles A. Heiken and E. Robert Wiese. Am. Rev. Tuberc. **63**: 480–486, April 1951.

Loeffler's syndrome is characterized by pulmonary involvement and a considerable disparity between clinical and laboratory findings. The pulmonary disease as observed roentgenographically may range from small infiltrations to extensive shadows which may be unilateral or bilateral and may involve one or several lobes. The fleeting, migratory character of the infiltrations is characteristic. The general health of the patient is often unimpaired; symptoms, when present, are slight fatigue and lassitude, scanty mucopurulent sputum which may contain eosinophils, and at most a slight elevation of temperature.

Eosinophilia is usually marked, varying from 10 to 30 per cent in patients with total white counts ranging from 12,000 to 15,000 cells per cubic millimeter. No correlation between the degree of eosinophilia and the extent of the pulmonary involvement has been noted. The syndrome is thought to be a manifestation of allergy to one of a number of allergens.

Since the disease is benign, very little histopathologic material is available, but studies are reported in a few cases. Grossly, the appearance of the pulmonary infiltrate is not unlike that of bronchopneumonia; microscopically the inflammatory exudate is made up largely of eosinophils and there is extensive eosinophilic infiltration in the parenchyma, with similar infiltration in the liver and spleen.

Two cases are reported with typical eosinophilia and transient pulmonary infiltrations.

Eleven roentgenograms.

JOHN H. JUHL, M.D.
University of Wisconsin

Pulmonary Mycoses—Coccidioidomycosis and Pulmonary Cavitation. A Study of Ninety-Two Cases. William A. Winn. Arch. Int. Med. **87**: 541–549, April 1951.

Of the exogenous mycoses attacking the lung, coccidioidomycosis is the most important in the western states of this country. Organized pulmonary lesions tend to persist throughout the general group of mycoses which affect the lung. Pulmonary coccidioidal disease, in particular, is prone to leave residua, such as single or multiple solid foci, coccidioma, cavitation, persistent hilar adenopathy, calcification and, less often, localized bronchiectasis and fibrosis.

In an earlier paper the author described the clinical and roentgenographic findings in 40 cases of primary coccidioidomycosis and called attention to the persistent pulmonary changes residual to the initial infection, especially pulmonary cavitation (Ann. Int. Med. **17**: 407, 1942. Abst. in Radiology **40**: 524, 1943). Of these pulmonary lesions, the residual cavity has continued to be most intriguing. Varying in size from 1 to 14 cm. and producing hemoptyses in 65 per cent of the patients observed, it is otherwise characterized by the production of minimal signs and symptoms. In one-fourth of a group of 92 patients such cavities existed for months or even a few years and then closed spontaneously. In another 10 per cent pulmonary cavitation persisted over a number of years without evident harm. In 6 per cent of the cases the cavity filled and formed a persistent nodule resembling a neoplastic focus. In 2 per cent of the series spontaneous pneumothorax followed transpleural rupture of the cavity.

Because of frequent hemoptysis or increasing size of the cavities, one-third of the persons were treated by simple pulmonary collapse procedures, such as pneumothorax or pneumoperitoneum. Larger cavities demanded thoracic surgical intervention, such as lobectomy and pneumonectomy. Fourteen cases in the present series required pulmonary resection.

The author has seen no dissemination of disease from a residual pulmonary cavity nor any evidence of transmission of the infection from one person to another during more than ten years of observation of coccidioidal disease in the San Joaquin Valley.

Thirteen roentgenograms.

Pulmonary Histoplasmosis. Summary of Data on Reported Cases and a Report on Two Patients Treated by Lobectomy. Corrin H. Hodgson, Lyle A. Weed, and O. Theron Clagett. J. A. M. A. **145**: 807–810, March 17, 1951.

A brief summary is presented of some aspects of the 138 authenticated cases of histoplasmosis in the literature. All these were proved either by histologic or bacteriologic methods. In nearly one half the cases the diagnosis was not made until necropsy; in 47 by biopsy, in 16 by culture, and in 11 by direct microscopic examination of sputum, pleural fluid, pus, etc. In 71 cases one or more cultures were made, and at least one of these was positive in 61 patients. Animal inoculation gave positive results in 12 of 21 cases. The histoplasmin skin test was tried in 31 patients but in only 16 was it positive. Precipitin and complement-fixation tests were unreliable.

Of the 138 patients, 23 were still alive when last heard from, some as long as four or five years.

Ninety-six cases came to autopsy, showing involvement of the following organs in decreasing order of frequency: lymph nodes, liver, lungs, spleen, adrenal glands, intestines, bone marrow, kidneys, and oropharynx. In some 25 per cent of the series another major disease was also present. Six patients had Addison's disease because of the destruction of the adrenals.

In 65 cases of the series there was lung involvement, proved by recovery of organisms or tissue examination. In 8, x-ray examination was negative; 40 showed

abnormal findings. Thirty-two patients were said to have bilateral and 8 unilateral lesions roentgenographically. Involvement was widespread throughout all parts of both lungs in 22 cases. Written reports by various roentgenologists are difficult to interpret and correlate, but their statements may be rather roughly classified as follows: In 17 cases the condition was described as "bronchitis," "peribronchial infiltration," etc.; in 17 others various terms were used to signify localized areas of infiltration; a localized area of "pneumonitis" was mentioned in 5; the term "miliary" was used to describe the lesion in 4, and definite "nodules" were seen in 4. In only 4 instances would it seem that the lesion resembled the reinfection type of tuberculosis in the apices of the lungs. Calcification was noted in 11 instances. Cavitation was reported in only 3 cases and may not have been due to histoplasmosis in all of these. To summarize, then, it may be said that pulmonary histoplasmosis has no characteristic roentgenographic appearance but may resemble almost any lesion seen in the lungs.

Two cases of pulmonary histoplasmosis are reported in which lobectomies were done for circumscribed lesions; both patients have remained well. One had a large mass in the right base, thought to be an infected cyst, while the other had a lesion in the upper lung field indistinguishable from a moderately advanced tuberculosis with cavitation.

One roentgenogram; 1 photograph; 1 photomicrograph.

ZAC F. ENDRESS, M.D.
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Incidence of Lipoid Pneumonia in a Survey of 389 Chronically Ill Patients. B. W. Volk, L. Nathanson, S. Losner, W. R. Slade, and M. Jacobi. Am. J. Med. **10:** 316–324, March 1951.

A survey of 389 chronically ill patients revealed 57 cases of lipoid pneumonia, diagnosed by examination of the sputum or of material aspirated from the lung and roentgen studies of the chest. The majority of the patients in this group had diseases of the central nervous system. The rest were admitted because of rheumatoid arthritis, arteriosclerosis, hypertensive heart disease, or progressive muscular dystrophy. From the history it was elicited that 50 (87.7 per cent) had previously taken mineral oil, nose drops, or oil-containing medication over a period varying from a few weeks to several years. In 55 of the patients the sputum showed lipophages or abundant amounts of free lipoid material characteristic of lipoid pneumonia. Aspirated material also revealed typical lipoid-containing macrophages. Many of the patients had no signs or symptoms of pulmonary disease. Others gave a history of intermittent cough, occasionally productive, or of dyspnea. Twenty patients had fine or coarse moist râles, primarily in the right lower lobe or over both bases upon auscultation.

The chest roentgenograms of 20 patients were considered characteristic of lipoid pneumonia. The sputum was consistently negative in 1 of these patients, although a positive aspiration was obtained. The routine postero-anterior roentgenograms of the remaining 37 patients were not sufficiently characteristic to justify a diagnosis of lipoid pneumonia. Following the finding of either a positive sputum or aspiration biopsy, or both, these patients were restudied with lateral, oblique and, when indicated, overexposed films. In 31 patients there appeared to be considerable retrocardiac and peribronchial infiltration; in 13 the retrocardiac changes were sufficiently pronounced, with distinct peribronchial and segmental infiltration, to suggest the probability of an aspiration pneumonia involving the most dependent portions of the lung fields, consistent with lipoid pneumonitis. Eighteen of the patients showed considerable peribronchial exaggeration and parenchymal fibrosis of both lungs which could not be considered radiographically positive for lipoid pneumonia. These findings, however, may indicate early or late changes of the disease. In 6 patients in whom the roentgenograms were considered normal, a positive sputum and positive aspiration were obtained.

The authors conclude that lipoid pneumonia occurs more frequently among the chronically ill than is generally believed. Its recognition is of particular importance in those patients in whom a diagnosis of bronchogenic carcinoma is entertained, since it may prevent needless surgical procedures. There was no instance of complicating lung neoplasm in the present series, although the patients were followed for many years. The differentiation of lipoid pneumonia from other low-grade pulmonary infections and bronchiectasis is also important from the therapeutic standpoint.

Re-aspiration of disintegrated lipophages is suggested as the mechanism for the progression of the disease after the discontinuance of the inciting oily factors.

Seven illustrations, including 4 roentgenograms; 1 table presenting data on the 57 patients.

Cystic Lymphangioma of the Mediastinum. P. Santy, P. Galy, Jaubert, and M. de Beaujeu. J. franç. méd. et chir. thorac. **5:** 278–284, 1951. (In French)

Two cases of cystic lymphangioma involving the mediastinum are presented, with a brief review of the literature. The usual location of this tumor is in the anterior superior mediastinum. On the routine roentgenogram the appearance may simulate that of a substernal goiter. Rarely the localization is paratracheal or just above the diaphragm near the cardiac silhouette. The mediastinal lymphangioma may attain a relatively large size. The cystic mass is deformed by respiratory movements. The contour is sharply demarcated, and at times lobulations can be seen in different views. The age incidence has been reported as from two up to eighty years. The patients are often asymptomatic until the tumors are quite large. Surgical removal is sometimes difficult because of the adherence to surrounding tissues.

Because of their location in the anterior mediastinum, cystic lymphangiomas may be confused with bronchogenic and thymic cysts and the celomic cyst or pleuropericardial cyst.

Seven roentgenograms: 1 photomicrograph.

CHARLES M. NICE, M.D.
University of Minnesota

Pulmonocardiac Failure. Report of a Case. W. F. O'Connell and Y. C. Lee. Pediatrics **7:** 394–399, March 1951.

In 1939 Chapman, Dill and Graybiel (Medicine **18:** 167, 1939) presented clinical and laboratory data for 12 patients who suffered from pulmonocardiac failure, with death occurring in 4. A review of the literature at that time revealed 126 fatal cases; 6 have since been recorded. In all patients the cardiac and respiratory embarrassment has resulted from a deformity of the

spine and/or thorax which caused a decrease in volume and in expansion of the thoracic cage, as scoliosis, kyphosis, lordosis, kyphoscoliosis, and pectus excavatum or carinatum.

The etiology of the deformity is not always obvious. It usually develops during childhood, achieving its maximum effect by the time the patient has attained full growth. In the 126 cases reviewed by Chapman *et al.* the kyphoscoliotic curvature was to the right in all but 15.

The outstanding symptom in severe deformity of the chest is dyspnea, usually present for many years. However, the patient is able to carry on normal or moderately restricted activity until the relatively sudden appearance of severe paroxysmal dyspnea, nocturnal dyspnea, weakness, palpitation, or fainting, which mark the onset of terminal pulmonocardiac failure. In the terminal stage respiratory distress is severe. Tachycardia is a frequent finding. Because of the chest deformity cardiac enlargement may be difficult to determine roentgenologically.

The sequence of events in these cases would seem to be (1) a decrease in respiratory capacity; (2) an increase in pulmonary resistance and pulmonary arterial pressure acting over a long period of time; (3) right ventricular hypertrophy and dilatation with eventual fatal cardiac and respiratory failure.

A typical case with certain unusual features is presented. The unusual features were: first, the presence of marked congenital spine and rib deformities with an extreme anomaly of the diaphragm; second, the presence of dyspnea almost from birth, with the terminal illness occurring at ten years, in contrast to the usual survival to thirty or more years of age.

Three roentgenograms.

Beriberi Heart in Iowa Veterans. Charles H. Gutenkauf. Circulation **3**: 352–362, March 1951.

The author reports 5 cases of beriberi heart disease recognized at the Des Moines Veterans Hospital among 7,912 admissions between October 1948 and January 1950. None of these Iowa residents had been a prisoner of the Japanese. All were white men between the ages of thirty-two and thirty-nine who consumed excessive amounts of alcohol. The thiamine intake of each (diet and alcohol) had been approximately 0.15 to 0.26 mg. per 1,000 calories. All 5 cases conformed for the most part to Blankenhorn's diagnostic criteria (Ann. Int. Med. **23**: 398, 1945): (1) enlarged heart with sinus rhythm; (2) dependent edema; (3) elevated venous pressure; (4) peripheral neuritis or pellagra; (5) non-specific changes in the electrocardiogram; (6) no other cause evident; (7) gross deficiency of diet of three months or more; (8) improvement and reduction of heart size after specific treatment, or autopsy findings consistent with beriberi.

In the present series 4 patients had roentgen evidence of cardiac enlargement, which disappeared with therapy. Angiocardiograms in one case revealed dilatation and thickening of the wall of the left ventricle, which decreased markedly during two months of treatment.

In many cases rest and the usual hospital diet result in striking improvement within a few hours. Four patients in the series had moderate improvement in the signs of congestive failure before parenteral thiamine was given. The time required for maximum decrease in heart size varied from one to two months.

Four roentgenograms; 3 electrocardiograms; 3 tables.

Single Ventricle with a Rudimentary Outlet Chamber. Case Report. Edward C. Lambert. Bull. Johns Hopkins Hosp. **88**: 231–238, March 1951.

A case of a single ventricle with a rudimentary outlet chamber, complicated by an anomalous tricuspid valve and transposition of the great vessels, is reported. The relation between the anatomical findings and the clinical features and the data obtained from cardiac catheterization and angiocardiography is discussed.

On fluoroscopic examination the heart appeared obviously enlarged to the right and left in the anteroposterior view. The pulmonary conus was concave. There were, however, very large pulsating pulmonary arteries in both hilar regions. The left anterior oblique view was interpreted as showing a markedly enlarged right ventricle and slight enlargement of the left ventricle.

For angiocardiograms, injection was made by way of the right basilic vein, and both anteroposterior and left lateral series were obtained. The contrast solution entered the heart by way of a moderate-sized right-sided superior vena cava and passed into a large right atrium. The medium appeared to linger in the right side of the heart for an abnormally long time: there was still a considerable concentration of the dye in the region of the right atrium at the end of approximately eight seconds. In the lateral series, at the end of about four seconds, there was suggestive opacification of the left side of the heart, which was believed to indicate the presence of a septal defect. The aorta was faintly opacified at the end of three to four seconds, but the degree of concentration of dye within the vessel never became very great. The aorta appeared to arch to the left. In the lateral projection, it appeared to arise fairly far anteriorly. There was no opacification of the pulmonary trunk or of its major branches. There was, however, some slow opacification of the hilar and peripheral parenchymal markings.

The patient appeared to be temporarily benefited by the surgical creation of an auricular septal defect, but death ensued on the seventh postoperative day, probably due to a massive hemothorax.

Two roentgenograms; 1 electrocardiogram; 1 drawing.

Cardiac Aneurysm: Clinical and Electrocardiographic Analysis. John B. Moyer and Glenn I. Hiller. Am. Heart J. **41**: 340–358, March 1951.

Twenty cases of ventricular aneurysm are reviewed. In 12 of these the diagnosis was substantiated by necropsy and in the remaining 8 by suitable clinical and roentgenologic studies. Three of the antemortem group are considered "idiopathic" aneurysms, since no definite etiologic basis was found. The group includes 16 male and 4 female patients, with an average age at the time of diagnosis of sixty-two years.

There are no symptoms characteristic of ventricular aneurysm. Physical signs are variable and usually unreliable, the only important sign being a pulsation separate from that of the apex. No characteristic cardiac murmurs are produced.

Since cardiac aneurysms vary in their location, adequate roentgen examination requires multiple plane projections of the chest and careful fluoroscopy, particularly if small aneurysms are to be demonstrated. Schwedel (*Clinical Roentgenology of the Heart*, Paul B. Hoeber, 1946, pp. 87–102) gives the following radiographic criteria for the diagnosis of ventricular aneurysm: (1) localized bulge; (2) pericardial adhesions

giving systolic traction on adjacent lung or diaphragmatic pleura, although such adhesions are not due to ventricular aneurysm; (3) increased density due to mural thrombus which may occasionally contain calcium deposits; (4) ventricular incisura or angulation between the site of the bulge and uninvolved portions of the ventricle; (5) abnormal pulsations. In the majority of instances, pulsation of a ventricular aneurysm is asynchronous or contrapulsile, bulging outward when the remainder of the ventricle contracts. However, and especially in the presence of a mural thrombus, pulsation may also be synchronous and systolic as well as strong or weak. When the left ventricle is enlarged, a segment which shows diminished amplitude of pulsation alone is not sufficient for a diagnosis of ventricular aneurysm. When such a segment of diminished amplitude is associated with pericardial adhesions, increased density, or a ventricular incisura, the diagnosis of ventricular aneurysm is enhanced. It is difficult or impossible to diagnose massive aneurysms involving most of the lateral wall, the posterior wall, or apex of the left ventricle. Massive aneurysmal involvement of the left ventricle may simulate simple left ventricular hypertrophy. The posterior wall is poorly contrasted with mediastinal structures so that aneurysm in this location is difficult to demonstrate. Displacement of a barium-filled esophagus may be helpful. Production of a gas bubble in the stomach with effervescent materials may give sufficient contrast to reveal an aneurysm at the apex of the heart. Roentgenkymograms permit detailed study of pulsations. Angiocardiography may demonstrate an aneurysmal bulge if a mural thrombus is not present.

There is no electrocardiographic pattern characteristic of ventricular aneurysm. Electrocardiographic changes, when present, are those of antecedent extensive myocardial infarction and do not differ from those in similar cases uncomplicated by ventricular aneurysm.

Failure to verify the presence of extensive myocardial infarction by electrocardiography in the presence of abnormal bulges on the cardiac silhouette demonstrable by roentgen study does not exclude, but should cast serious doubt on the diagnosis of ventricular aneurysm.

Five roentgenograms; 13 electrocardiograms; 1 table.

Aortic Atresia with Hypoplasia of the Left Heart and Aortic Arch. Sidney Friedman, Lois Murphy, and Rachel Ash. J. Pediat. **38:** 354–368, March 1951.

Four cases of congenital aortic atresia with hypoplasia of the left heart are presented, together with a review of the literature. Cases with associated deformity or absence of the mitral valve are excluded.

The etiology, clinical diagnosis, and pathologic physiology of the malformation are briefly discussed. Roentgenographic and fluoroscopic examination in 3 of the cases confirmed the presence of massive cardiac enlargement, which in 2 instances almost obscured the lung fields, associated with fullness of the pulmonary segment. In the right anterior oblique view, the filling of the retrosternal space by the cardiac shadow suggested a right ventricular hypertrophy. Taussig (Bull. Johns Hopkins Hosp. **76:** 75, 1945. Abst. in Radiology **45:** 629, 1945) has described similar fluoroscopic findings due to enormous enlargement of the right ventricle with distention of the pulmonary artery, the right atrium, and superior vena cava. In 1 of the authors' cases the roentgenograms taken at birth and again at ten days of life failed to demonstrate any marked degree of cardiac enlargement, but at necropsy, eight days later, enlargement of the right ventricle was found. This represents an exception to the rule that in these cases demonstrable cardiac enlargement is usually present at the time of birth.

Production of an interatrial defect would be the only helpful surgical procedure in this type of congenital heart disease, but in view of the profound distortion of the hemodynamics little permanent benefit can be anticipated even if the enormous technical difficulties could be surmounted.

Three roentgenograms; 3 electrocardiograms; 1 drawing; 1 table.

Congenital Valvular Pulmonary Stenosis With or Without an Interatrial Communication: Physiologic Studies as Diagnostic Aids. Forrest H. Adams, George Veasy, Joseph Jorgens, Antoni Diehl, John W. LaBree, M. J. Shapiro, and Paul F. Dwan. J. Pediat. **38:** 431–441, April 1951.

During the past two and one-half years, the authors have made physiologic studies in over 200 children and young adults with congenital heart disease, using the right heart catheterization technic. They have encountered 19 patients with either isolated valvular pulmonary stenosis or pulmonary stenosis accompanied by an interatrial communication. An additional patient was found to have pulmonary stenosis with a patent ductus arteriosus.

The findings in 8 of the patients were interpreted as indicating isolated pulmonary stenosis and, in 11 of the patients, pulmonary stenosis with an interatrial communication. Isolated pulmonary stenosis was thought to be present when the systolic pressure of the right ventricle was higher than that in the pulmonary artery, and there was no evidence of a left-to-right or a right-to-left intracardiac shunt. An interatrial communication was considered to be present when the catheter was passed through the communication into the left atrium or when there was evidence of a left-to-right shunt in the right atrium.

The range of the systolic right ventricular pressures in the patients was from 40 to 260 mm. of mercury and the range of the systolic pulmonary artery pressures was from 2 to 28 mm. In general, the higher the right ventricular pressure, the greater were the symptoms and physical findings. The right atrial pressures obtained in this study were not strikingly elevated.

The symptoms and clinical findings in patients with uncomplicated valvular pulmonary stenosis are: varying degrees of cardiac disability from none to severe dyspnea with or without mild cyanosis; a loud systolic murmur over the left precordium with a decreased pulmonary second sound; right axis deviation on the electrocardiogram; right ventricular enlargement with a prominent pulmonary artery segment, decreased root shadows, and decreased vascular markings in the lung fields on roentgen examination. In those patients with an interatrial communication, cyanosis is a more prominent feature.

One photograph; 6 tables.

HOWARD L. STEINBACH, M.D.
University of California

THE DIGESTIVE SYSTEM

Heterotopic Gastric Mucosa in the Esophagus with Ulceration and Stricture Formation. Lewis H. Bosher, Jr., and Frederick H. Taylor. J. Thoracic Surg. 21: 306–312, March 1951.

A 63-year-old woman complained of dysphagia of fifteen years' duration, food seeming to catch in the mid chest region. In the six months prior to admission she had been able to swallow only liquids, and had lost twenty pounds in weight. Occasionally she suffered small hematemeses. Roentgen studies demonstrated fusiform narrowing of the esophagus at the aortic arch. Additional studies culminated in thoracotomy with resection of the lower half of the esophagus.

Superficial ulcerations were present in the proximal end of the 10-cm.-long specimen and the lumen was constricted. The submucosa was fibrotic and thickened in that area. An additional segment of esophagus was resected and found to be lined with stratified squamous epithelium. The longer specimen was lined by gastric mucosa, containing glands with goblet cells but no parietal cells. Maximum esophageal constriction occurred just proximal to the transition from gastric to squamous epithelium.

Three roentgenograms; 5 photomicrographs.

DONALD DEF. BAUER, M.D.
St. Paul, Minn.

Neurovascular Mechanism of the Stomach and Duodenum. H. B. Benjamin. Surg., Gynec. & Obst. 92: 314–320, March 1951.

In this study an attempt is made to correlate vascular changes in the gastric mucosa with the etiology of ulcers. The author is concerned particularly with neurovascular mechanisms and with what they do to alter temperatures regionally.

Reference is made to Decker, who in 1887 reported the production of ulcers in dogs by feeding them gruel at high temperatures. The theory of Necheles that the swallowing of hot food might temporarily cause vasoconstriction and local anoxia is recalled, as is Krogh's observation that when blood flows at an unusually slow rate, the oxygen present is used up and a regional tissue anoxia follows.

In this study the right gastric artery, the left gastric artery, and the right and left gastro-epiploic arteries are dealt with in their intricate relationships with the cardiac-fundic and the pyloric regions of the stomach. A correlation of vascular changes with the areas of the stomach and duodenum most often affected by ulcer is attempted.

Stomachs obtained at postmortem examinations and surgical procedures were used in some of these studies. In others, specimens from dogs, rabbits, and monkeys were used. Injection of vessels of the stomach with radiopaque materials (red cinnabar or bismuth oxychloride in water) and examination of the x-ray films of such specimens with a microscope constituted the method of study. Plastics were used for the gross demonstration of blood vessels.

Roentgenograms showed coarse vessels in the cardiac-fundic area and much smaller ones in the pyloric region. The stomachs injected through the right gastric artery showed a vascular pattern in the pyloric region and not in the remainder of the organ.

It was found repeatedly that stimulation of the distal stump of the right vagus nerve caused a blanching of the pylorus. Microscopic examination of the vessels in all the layers of the gastric wall showed a lack of contrast material. The author states that " it is apparent that this is not a shunting phenomenon within the organ but diversion of the blood to other organs, such as the liver or pancreas." After stimulation of the distal stump of the right vagus nerve the gastric contents were highly acid, strongly peptic, and watery. With stimulation of the left vagus nerve the pylorus appeared as a solid mass of vessels and the flow of pepsin and hydrochloric acid was decreased.

The author concludes by noting that "Ivy, Grossman and Bachrach in their book on peptic ulcers stated, 'The best way to account for the circumscribed nature of the acute ulcer caused by acid or any other ulcerogenic agent is by assuming a local disturbance of the blood supply.' "

Nine roentgenograms.

LOIS I. KING, M.D.
University of Pennsylvania

Inflation of the Stomach with Double Contrast. A Roentgen Study. Francis F. Ruzicka, Jr., and Leo G. Rigler. J. A. M. A. 145: 696–702, March 10, 1951.

The authors point out that, with the increasing use of routine roentgen examination of the stomach, small lesions are being discovered in ever-increasing numbers, and additional methods should be explored to permit the more accurate diagnosis of lesions 1 cm. or less in diameter. When such lesions are under consideration, especially when the roentgen findings are the only indication for radical surgery, the necessity for the most exacting type of examination becomes obvious. The procedure described in this paper as a supplemental examination to be used in selected cases after routine study has revealed abnormal or questionable findings, consists in the injection of air into the stomach after a single swallow of a thin barium mixture to achieve coating of the walls.

With air distention of the stomach, flattening of prominent but otherwise normal rugal folds occurs, while actual polyps remain unaltered. Barium-coated polyps thus demonstrated are rather characteristic in appearance. Larger polyps may appear as more or less homogeneous shadows with a dense shell-like periphery. With smaller polyps, only an outline may be seen—an oval or circular ring of density.

In addition to the more certain detection of polyps, the method has been used as an aid in differentiating between localized giant rugae made prominent by physiologic contraction of the muscularis mucosae and folds actually infiltrated by tumor or tumor presenting the appearance of giant rugae. Pliability or non-pliability of the gastric wall may also be demonstrated.

Illustrative cases are cited and 18 roentgenograms are reproduced.

EVERETT L. PIRKEY, M.D.
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Barium Modification with Methocel. Mark M. Marks. Am. J. Surg. 81: 6–8, January 1951.

In the search for a medium in which the barium remains in finer suspension, and thus allows the diagnosis of smaller lesions of the gastro-intestinal tract, many barium mixtures are being studied. The author describes here a method for maintaining the barium in more permanent suspension by the addition of a cellulose ester.

Barium in a methyl-cellulose suspension on micro-

scopic examination shows a constant dispersion of the barium salt particles as long as fluid remains. Brownian movement can be seen until dehydration results in the formation of a gel. It is felt, therefore, that the addition of methyl cellulose creates an iso-electric form of barium.

The suspension is stated to be non-irritating and completely miscible with the intestinal stream, and to produce a mucosal pattern of fine detail. It is regarded as a practical improvement over the barium-water mixture.

Further study is required to determine which, if any, of the many suspensions under investigation is superior.

Eight roentgenograms. JOHN F. WEIGEN, M.D.
University of Pennsylvania

Villous Tumor of the Stomach. Clinical Review and Report of Two Cases. L. Walk. Arch. Int. Med. **87**: 560–569, April 1951.

The villous tumor or cauliflower-like papilloma of the stomach has not been consistently differentiated from the ordinary polyp, probably because histologically both are adenomas. Even the term papilloma has been used for both, and this has led to confusion. The villous tumor should be differentiated from the ordinary polypoid growth because of its different clinical appearance and its higher rate of malignant change. Apparently a villous tumor begins as a benign adenoma, but soon shows chronic inflammatory changes with the development of a state of chronic tissue irritation which eventually leads to malignancy. Therefore, resection of the stomach should be performed; simple excision of the tumor is not sufficient.

The author analyzes the 51 cases of villous tumor recorded in the literature and adds 2 of his own. The clinical findings have usually been dominated by a grave anemia. The onset of complaints is gradual. In 12 cases there were vague gastric symptoms. Eighteen patients reported epigastric pain, varying in character and intensity. Pains resembling those of ulcer were recorded in 2 patients. In 4 patients diarrhea was the dominant symptom.

Most villous tumors in which the consistency was mentioned were soft. On many occasions this soft consistency on palpation and the great mobility of the stomach have probably been confusing. Growths up to 8 cm. in size in the lower part of the stomach have thus escaped detection.

Roentgenologically, the villous surface can be identified in many published cases. Lack of familiarity with this rare tumor, which is not mentioned in handbooks of diagnostic roentgenology, seems to be responsible for the fact that usually the diagnosis of simply a papillomatous or polypous growth has been made. The characteristic surface, resembling soap bubbles (*mousse de savon*) on the roentgenogram, will probably establish the true nature of the neoplasm in most cases. In one instance an ulceration of the gastric wall at the site of the tumor was visible.

The prognosis in the surgically treated cases would be expected to be better than in cases of ordinary cancer, as a villous growth frequently is only precancerous. On the other hand, most villous tumors produce an anemia which, if observed in a case of ordinary cancer, would make the surgeon hesitate to operate. Massive blood transfusions, together with prolonged medical treatment, have apparently not been sufficiently used. There are cases in which no metastases were to be seen at necropsy, death occurring from some other cause, and in several others the findings were minimal. Thus, the anemia itself is not a contraindication for surgery after proper preparation of the patient.

Four roentgenograms; 4 photographs; 5 tables.

Perforation of Gastric Ulcer Secondary to Trichobezoar. Report of a Case in Which the Patient Survived. John D. Osmond, Jr., and Jay B. Price. J. A. M. A. **145**: 818–819, March 17, 1951.

The authors report what they believe to be the seventh case of perforation of a gastric ulcer due to a trichobezoar, and the first with survival. The survival they attribute to the use of antibiotics following operation. The six earlier cases were observed before the introduction of penicillin and streptomycin.

The patient was a girl, eight years old, with a history of trichophagia for three years and acute abdominal pain beginning thirty-three hours before admission. Preoperative films showed free air below the diaphragm and a mottled soft-tissue mass corresponding with the stomach outline. Since the history of trichophagia was known, the diagnosis of bezoar was made. At operation the bezoar was removed and the perforated ulcer closed. Recovery was complete; no abnormality could be found on subsequent x-ray examination of the stomach.

One roentgenogram; 1 photograph.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Prolapsing Redundant Gastric Mucosa. Galen M. Tice and Thomas G. Orr. J. Kansas M. Soc. **52**: 110–113, March 1951.

The authors state that it is only within the past few years that they have become definitely aware at the University of Kansas School of Medicine of prolapse of the gastric mucosa into the duodenum as a clinical entity. They are convinced that the diagnosis can be made only by the roentgenologist, since no classical group of symptoms has been recognized. The duodenal bulb shows what has been described as a "mushroom," "umbrella," or even "atom bomb" appearance. The base is concave. The mucosa presents a "crumpled silk" pattern. In the pylorus the mucosal folds stand out as isolated parallel strands running into the bulb as multiple opaque streaks. There may be such slight mucosal herniation that it will be overlooked, or it may be transient and not observed every time the stomach is examined. The other extreme may be a filling defect due to a constant mucosal herniation that amounts to an intussusception, in which case there is a permanent defect and a palpable mass that may lead to a diagnosis of antral carcinoma. There is no disturbance in peristalsis in the average case. The duodenal bulb retains barium well and is not irritable.

The various etiologic theories are reviewed, and treatment is briefly discussed. Three cases treated surgically, primarily for bleeding, are reported. In none of these, however, was it certain that the prolapsed mucosa was the source of the hemorrhage.

One roentgenogram; 1 photograph.

Gastro-Colic Fistula of Unexplained Origin. Enrico Uehlinger. Radiol. clin. **20**: 122–124, March 1951. (In German)

A 57-year-old woman complained of continuous dull pain under the left costal margin for one to two years.

Loss of appetite, belching, constipation, diarrhea with mucus-containing stools, and a weight loss of 10 kg. were experienced. Tests for blood in the stools were occasionally positive, and a tentative diagnosis of carcinoma of the colon was made.

A barium enema revealed the escape of contrast material from the splenic flexure of the colon into the greater curvature portion of the stomach through a smoothly delineated tract 2 to 3 mm. wide and 3 cm. in length. Resection of the communicating structure revealed it to be a cord, the lumen of which was lined by gastric mucosa of the fundus type. There were no signs of past or present inflammation.

A congenital anomaly is an unsatisfactory explanation here because of the comparatively late onset of symptoms. Nor is there any embryological basis for such an anomaly. The possibility of a ruptured gastric or colonic diverticulum might be considered.

Two roentgenograms.

GERHART S. SCHWARZ, M.D.
New York, N. Y.

Radiologic Examination of the Small Intestine by Means of the Duodenal Tube, Especially for the Diagnosis of Tumors. A. Lurà. Radiol. clin. **20**: 97–111, March 1951. (In French)

The various methods of examination of the small intestine are discussed. By means of the small intestine enema given through the duodenal tube, all portions of the small bowel from the second portion of the duodenum to the terminal ileum may be visualized in a relatively short time. By utilizing change of position, such as the Trendelenburg position, and by manual pressure, most of the loops may be separated. Roentgenograms are reproduced to show tumors, inflammation, parasites, and pressure of extrinsic masses.

Twenty-three roentgenograms.

CHARLES M. NICE, M.D.
University of Minnesota

Roentgen Findings in Four Cases of Small-Intestinal Tumor. Karl Schaub. Radiol. clin. **20**: 14–20, January 1951. (In German)

The most common tumors of the small intestine are carcinomas, carcinoids, and sarcomas. Of the carcinomas, 45 per cent are found in the duodenum; about twice as many occur in the jejunum as in the ileum. Carcinoids are seen almost exclusively in the distal portion of the ileum. Sarcoma is more frequent in the ileum than the jejunum. Of primary benign tumors, the neuroma most often undergoes malignant change.

The author describes four of his own cases: a lymphosarcoma producing evidence of small bowel obstruction; malignant change in a familial neurofibromatosis, with partial obstruction of the jejunum; 2 solitary malignant neurofibromas. One of the latter tumors was located in the distal portion of the descending part of the duodenum and resembled radiologically, a diverticulum. In the other case the lesion was in the region of the duodenojejunal junction, giving rise to an irregular filling defect.

Anemia was clinically present in all these cases. The author, therefore, suggests the necessity for careful radiologic study of the small bowel in all cases of unexplained intestinal bleeding.

Five roentgenograms; 2 photographs.

EUGENE F. LUTTERBECK, M.D.
Chicago, Ill.

Malignant Tumors of the Duodenum. Report of Two Cases. Nathaniel H. Schwartz, Roy C. Swingle, and Edward A. Raymond. Arch. Int. Med. **87**: 410–417, March 1951.

Three per cent of all carcinomas occur in the small intestine, and of this number about 45 per cent are found in the duodenum. To date 483 well documented cases of primary carcinoma of the duodenum have been recorded. Duodenal sarcoma is extremely rare, its incidence being about 0.003 per cent, or one-tenth that of primary carcinoma. In contrast to carcinoma it occurs most often in young persons. The sex distribution is equal for both types of malignant growth.

Both carcinoma and sarcoma of the duodenum occur as polypoid or infiltrative growths. Carcinoma characteristically produces stenotic lesions with dilatation proximal to the obstruction, while sarcoma encroaches on the lumen only to a small degree, insufficient to cause obstruction. Ulceration occurs in both, leading to hemorrhage. Metastasis is usually late, involving the regional lymph nodes, liver, pancreas, and lungs.

The earliest complaints of patients having malignant tumors of the duodenum are of vague epigastric fullness, upper abdominal pain, anorexia, nausea, vomiting and gaseous eructations. Weakness and anemia may be present likewise, the latter usually resulting from blood loss. Pain is of common occurrence and is variable in both character and location. As the disease progresses, there may be a gradual and oftentimes sudden and dramatic change in symptoms. The later symptoms are due to the presence of obstruction, perforation of the bowel wall, ulceration and hemorrhage, and jaundice. Jaundice may result from encroachment on the biliary system through pressure on the common duct or obstruction of the papilla of Vater or metastasis to the liver.

The authors present one case of carcinoma and one case of leiomyosarcoma primary in the duodenum. Both of these tumors were in middle-aged women; both underwent surgical treatment, and both are surviving after eight and fifteen months, respectively. One case was tentatively diagnosed preoperatively by roentgenographic study. The importance of these tumors in differential diagnosis is emphasized.

Five roentgenograms; 2 photomicrographs.

HOWARD L. STEINBACH, M.D.
University of California

Giant Benign Duodenal Ulcer: Report of a Case. George Evashwick. Ann. Surg. **133**: 417–420, March 1951.

The author presents what he states is the twelfth reported example of giant benign duodenal ulcer. In most cases the ulcer crater has been so large as to simulate a normally filled bulb. Filling of the crater is rapid but emptying is delayed and the walls remain smooth, rigid, and unchangeable. Because the nonulcerated portion of the wall is stretched, the normal mucosal pattern and radiating mucosal rugae are not seen. In the case recorded here, a persistent air bubble was demonstrable in the duodenum when it was empty.

An antemortem diagnosis has been made in only 4 cases. All the other patients, including the author's, died as a result of hemorrhage or its complications.

Two roentgenograms; 1 photograph.

GEORGE R. KRAUSE, M.D.
Cleveland, Ohio

Roentgenologic Examination of the Colon Using Drainage and Negative Pressure, with Special Reference to the Early Diagnosis of Neoplasm. F. E. Templeton and E. A. Addington. J. A. M. A. **145:** 702–704, March 10, 1951.

With the aim of earlier diagnosis of neoplasms of the colon, the authors have devised a method and apparatus by which a double-contrast examination is possible in a single operation. A special valve controls the introduction of the barium emulsion, its removal, and the introduction of air into the colon.

The advantages of the immediate production of a double-contrast enema are listed. (1) The flow of barium can be immediately stopped at any point by drainage, and overlapping loops of colon can be examined before interfering filling occurs. (2) Palpation is easier, since the release of pressure causes relaxation of the abdominal wall, which the patient may have been holding tense in an attempt to retain the enema. (3) Air-contrast examination can be made of any particular point before it is obscured. (4) In the examination of the cecum, the sigmoid can be collapsed and the cecum examined more effectively.

The main difficulty encountered is the plugging of the discharge tubing by feces.

The method has been used in over 3,000 examinations.

Two photographs of the apparatus.

LAWRENCE A. PILLA, M.D.
University of Louisville

Roentgen Features of Non-Malignant Periappendiceal and Ileocecal Lesions. Charles Gottlieb, Samuel L. Beranbaum, and Milton Dorfman. Am. J. Digest. Dis. **18:** 79–86, March 1951.

It is difficult roentgenologically to differentiate between inflammatory and neoplastic lesions in the region of the cecum because of the great variation in its location and its anatomic and physiologic appearance. The authors enumerate the anatomic types and describe the normal appearances of the ileocecal valve, the sphincters of the colon, and the appendix. The latter, although it is found in almost every conceivable position with relation to the cecum, generally runs in one of three different directions: (1) over the brim, into the pelvis, (2) upward, behind the cecum, (3) upward and inward toward the spleen. Although foreign bodies have been shown in the appendix, their presence is rare, but concretions or calculi due to mucus or feces are quite common, and are often seen on the plain film.

Because of the differences normally observed in the position of the cecum, it may be difficult to tell when it is filled. Of major importance is the fact that the ileocecal valve is never at the inferior tip of the cecum. When it is demonstrated in this position, therefore, it may be assumed that filling of the cecum is incomplete, and re-examination with a barium meal is desirable.

The most frequent complication following appendectomy is adhesions, but their diagnosis is difficult. The only pathognomonic sign of their presence is the actual kinking or distortion of the course of the ileum.

A cecal filling defect may be produced either by carcinoma or a benign inflammatory process. An inflammatory mass will usually produce a more rounded defect with smoother borders than a carcinoma. A defect with narrow canalization and overhanging edges is strong evidence for a neoplasm.

The commonest inflammatory filling defect is secondary to an appendiceal abscess. Most commonly the defect is eccentric, on the medio-inferior aspect of the cecum. It is usually smooth, clear-cut, and distinct. If the mucosal pattern is studied, it will be found to show a normal outline.

Chronic inflammatory disease of the ileocecal region will produce hyperplastic changes demonstrable roentgenographically as a filling defect. This is especially true of granulomatous lesions.

Regional ileitis will show a defect in the lumen of the small bowel. Later polypoid hyperplasia occurs, resulting in irregularly outlined translucent areas. Eventually the wall becomes thickened and the appearance is that of a rigid tube with progressive narrowing of the lumen. Concomitant with the changes in the ileum, the cecum may show deformity due to spasm, to pressure by the inflammation in the ileum, or to actual cecal inflammation. This condition may be indistinguishable roentgenologically from tuberculosis.

Amebic colitis and idiopathic colitis produce a similar picture. The only finding suggestive of amebiasis is the preponderant susceptibility of the cecum to invasion.

Tuberculosis usually starts in the ileocecal region and may cause a narrowing of the terminal ileum. It is roentgenographically indistinguishable from non-specific granuloma. As a rule, the cecum is simultaneously involved. Classically, the terminal ileum shows changes ranging from transient spasm and mucosal irregularity to complete loss of mucosal markings, narrowing, irregularity, and rigidity of the walls, and presence of an ulcer crater. The cecum, too, shows changes indicative of inflammation. Mucosal irregularities, spasm and deformity of shape, and Stierlin's sign (a gap in the cecal shadow when the ileum and colon are filled) appear.

The ileocecal valve may become sufficiently enlarged to produce a filling defect on the roentgenogram and it would appear that hypertrophy of the valve and ileal prolapse into the cecum almost always occur together. The smooth round contours, the lack of obstruction, and the absence of local tenderness lend support to the final interpretation.

Sixteen roentgenograms with notes on the case illustrated.

JOSEPH T. DANZER, M.D.
Oil City, Penna.

Contribution to the Roentgen Diagnosis of Ceco-Colic Tumor Invagination. H. Garbsch and B. Thurnher. Radiol. clin. **20:** 71–76, March 1951. (In German)

The case of a 52-year-old male with vague abdominal complaints and signs of intermittent ileus is presented. Operation revealed invagination of the proximal colon into its transverse section. A partially ulcerated tumor measuring some 8 × 5 cm., with stippled calcifications, was found adherent to the cecum. Portions of the ileum and mesocolon had also invaginated. A right hemicolectomy was performed and the patient was discharged in good condition fourteen days later. The histologic diagnosis was submucous lipoma.

Roentgen studies (barium meal and barium enema) revealed the following signs: (1) delayed barium transit through the small intestine, with small bowel distention; (2) abnormal lateral dorsal rotation of the ileocecal junction instead of the usual medial position of the valve relative to the cecum; (3) a curved tapering of the caliber of the terminal ileum—the so-called "beak" formation; (4) presence of a barium-filled loop of small bowel in the colon; (5) apparent shortening of the

colon; (6) a filling defect in the colon; (7) spreading of barium between the normal colon wall and its invaginated section; (8) spiral-like haustrations of the external layer of the colon due to rotation and invagination of portions of the mesocolon; (9) a hemispherical space-occupying structure in the colon, representing the head of the intussusceptum; (10) varying location of the colonic obstruction; (11) reducibility.

The theory of invagination and the limitations of its roentgen diagnosis are discussed.

Four roentgenograms.

GERHART S. SCHWARZ, M.D.
New York, N. Y.

Endometriosis of the Recto-sigmoid. Gordon J. Culver and Milton V. Caldwell. J. Canad. A. Radiologists **2**: 6–11, March 1951.

Endometriosis involving the pelvic structures occurs in approximately 15 per cent of all women during their active menstrual life, and in about 25 per cent the lesions involve the rectosigmoid. Approximately 45 to 50 per cent of the rectosigmoidal lesions present symptoms indicating some degree of obstruction.

The common symptoms of endometroisis of the rectosigmoid include dyspareunia, menorrhagia, metrorrhagia, and unexplained sterility. Pain in the rectum on defecation may be experienced at the time of menstruation. Recurrent diarrhea without rectal bleeding may also occur with the menstrual period. Just before and during the period symptoms of low-grade obstruction may be present.

A hard, tender extraluminal mass may be found on digital rectal examination. Sigmoidoscopy may reveal narrowing of the lumen of the bowel with intact but hyperemic mucosa.

The findings on a barium enema study may be classified as constricting or non-constricting. With lesions of the constricting type there is a sharply demarcated annular narrowing of variable length with or without an associated filling defect produced by the endometrial tumor. This annular constriction is a result of the associated inflammatory reaction accompanied by spasm and, later, fibrosis. The mucosal folds through the area of the lesion are intact. With non-constricting lesions, a tender submucosal tumor can be demonstrated, with a normal overlying and surrounding mucosa. In some cases it is possible to demonstrate variations in the size of the lesion during different phases of the menstrual cycle.

The authors present two cases of endometriosis of the rectosigmoid illustrating some of these points.

Six roentgenograms; 1 photomicrograph; 2 tables.

DEAN W. GEHEBER, M.D.
Baton Rouge, La.

Retrorectal Tumors. Raymond L. Jackman, P. LeMon Clark III, and Newton D. Smith. J. A. M. A. **145**: 956–961, March 31, 1951.

Extrarectal masses occurring in the presacral or retrorectal region are much more common than the literature would indicate. During a 14-year period, 1935 through 1948, 114 patients with palpable retrorectal tumors were seen at the Mayo Clinic. In 32 patients (28 per cent) no tissue was removed and a definitive diagnosis could not be made. It is with the remaining 82 patients, who came to operation and for whom tissue was available for pathologic study, that the present paper is primarily concerned. This group was comprised of 39 women and 43 men. The tumors have been classified into five main categories:

1. Inflammatory tumors (18 cases)
2. Congenital tumors (32 cases: chordomas 14, teratomas 7, dermoid cysts 5, meningoceles 6)
3. Neurogenic tumors (12 cases: neurofibroma 5, ependymomas 6, neurilemmoma 1)
4. Osseous tumors (5 cases: osteogenic sarcoma 2, cartilaginous tumors 2, giant-cell tumors 1)
5. Miscellaneous tumors (15 cases: lipoma 2, plasma-cell myeloma 3, hemangio-endothelioma 2, fibrosarcoma and leiomyosarcoma 3, metastatic tumors 4, and unclassified 1).

While the 82 patients with determined tumors were about equally distributed between the sexes, certain specific types of tumors had a sex and age predilection; chordomas, for example, tended to occur in male adults, while teratomas and meningoceles were commoner in female infants and children than in other categories.

For the group as a whole the chief symptoms were backache, pain in the leg, and dysfunction of the bladder and bowel. Other complaints were rectal pain, constipation, paresthesias, and difficulty in walking.

A definite diagnosis in most instances could be made only after histopathologic study of tissue removed at operation or for biopsy. Roentgenologic study of the pelvis, however, was probably the most helpful single diagnostic procedure in separating these tumors into the three following groups:

(1) *Those arising from the sacral canal.* The commonest tumor in this group was the ependymoma, which causes erosion of the canal by expansion and pressure, the margins of the bone being sharp and well defined (neurofibromas may produce a similar picture).

(2) *Those arising from the sacral body itself.* Such tumors are commonly characterized by a picture of expansion of the sacrum by an infiltrative process.

(3) *Those arising from structures adjacent to the sacrum.* The teratoma, which belongs to this group, produces a picture of anterior sacral erosion and appears as an extrinsic mass which may contain teeth or bone.

The prognosis for patients who have inflammatory and congenital tumors, aside from chordomas, is good. Of the neurogenic tumors, the neurofibromas and neurilemmomas respond well to treatment. For the entire group of retrorectal tumors, the prognosis was favorable in about 50 per cent and poor in the remainder.

Three illustrations.

Roentgenologic and Pathologic Examinations of Tumors in the Region of the Pancreas. M. Lüdin and S. Scheidegger. Radiol. clin. **20**: 1–13, January 1951. (In German)

The diagnosis of extragastric lesions in the region of the stomach is often extremely difficult for the radiologist. There are recorded here two unusual cases in which the advanced age of the patient, the non-contributory history, and the absence of clinical symptoms, except for a palpable mass, were outstanding.

The first patient was an eighty-year-old male, with a large tumor causing marked displacement and distortion of the stomach, duodenum, and transverse colon. A diagnosis of probable pancreatic tumor was made and autopsy revealed a large malignant epithelial neoplasm originating from aberrant pancreatic tissue in the omentum.

In the second patient, a seventy-four-year-old female, the roentgen examination revealed what was interpreted as a large pancreatic cyst causing extensive displacement of the adjacent stomach and small bowel. An autopsy failed to confirm this diagnosis. The tumor originated from the omentum, had invaded the spleen and pancreas, and showed metastases to the regional lymph nodes. Histologically, it was a mixed malignant tumor containing blood and lymph vessels, connective tissue, fatty tissue, nerve fibers and lymphatic tissue.

Four roentgenograms; 6 photomicrographs.

EUGENE F. LUTTERBECK, M.D.
Chicago, Ill.

One Hundred Cases of Carcinoma of the Pancreas. A Clinical and Roentgenologic Analysis. Thomas Ray Broadbent and Herbert D. Kerman. Gastroenterology **17**: 163–177, February 1951.

The authors analyzed 102 cases of primary carcinoma of the pancreas seen at Duke University Hospital from July 1930 to May 1949. Of these, 72 (70.5 per cent) were located in the head and 30 (29.5 per cent) in the body of the gland. These cases comprised 0.61 per cent of 16,650 patients with cancer of various types. The average age was 58.2 years and there was a 1.85:1 ratio of males to females.

The most common chief complaint was pain, which occurred in 75 cases either on admission or during hospitalization. Jaundice was the chief complaint in only 6 cases on admission but subsequently developed in 49 cases. There was a palpable mass in 47 cases and the liver was enlarged in 57 cases. There were usually marked weight loss, abdominal tenderness, ascites, and gastro-intestinal symptoms.

Fasting blood sugar determinations were done in 43 cases and the level was below 110 mg. per cent in only 4. Several patients had concomitant diabetes mellitus.

In 76 of the 102 cases the roentgenologic studies were considered adequate for review. There are a variety of roentgen changes suggestive of cancer rather than other lesions. Invading lesions of the pancreas may produce slight alterations of the mucosa with disorganization of the usual feathery pattern of the valvulae conniventes of the duodenal loop. Distortion, irregularity, rigidity, a constant filling defect, and abnormal displacements of the associated anatomical structures are also seen. The major changes observed in carcinoma of the head of the pancreas were in the second portion of the duodenum. There were also displacement of the stomach and changes in the gastric mucosa. In carcinoma of of the body and/or tail, the most frequent findings were alterations involving primarily the third portion of the duodenum, but again changes in the second portion of the duodenum, displacement of the stomach, and gastric mucosal changes were also frequently observed. Frostberg's inverted "3" sign was present in only 7 cases.

At the time of the review study, critical evaluation of the roentgenograms significantly increased diagnostic accuracy over the original x-ray interpretation. Thus, on review 21.1 per cent were regarded as negative and a correct diagnosis was made in 53.9 per cent. In 25 per cent abnormal changes were noted but no definite diagnosis could be made.

Nineteen roentgenograms; 8 tables.

RODERICK L. TONDREAU, M.D.
Lincoln, Nebr.

Diffuse Calcification of the Pancreas. Bruno J. Peters, Joseph M. Lubitz, and M. C. F. Lindert. Arch. Int. Med. **87**: 391–409, March 1951.

Stones in the pancreas may be intraductal or parenchymal; the intraductal stones are usually solitary. When diffuse calcification is present, the clinical, roentgenologic, and pathologic picture is the same as that of so-called disseminated calcification of the pancreas, mixed calcification, or multiple stones. Calcific deposits in the pancreas, therefore, should be classified either as solitary stones or as diffuse calcification.

In the opinion of the authors, diffuse calcification of the pancreas is a clinicopathologic entity encompassing multiple calculi spread widely within the pancreas, accompanied by fibrosis, inflammation, and parenchymal damage. The size of the pancreas varies, but it is usually atrophic. The calculi are found to be within the ducts or in the immediate vicinity of dilated ducts or pseudocysts. The widened ducts often contain thickened pancreatic secretion. Microscopically, an intense fibrosis replaces the serous and islet tissue. Collections of polymorphonuclear cells, lymphocytes, or histiocytes are observed in the interstices. Calculi are found either in large or minor duct radicles or in spaces without perceptible epithelial lining.

Twenty-one cases of diffuse calcification of the pancreas are presented. Pathologic studies on 6 autopsy cases and one surgical case are included.

Common symptoms were recurrent epigastric pain with radiation to the back and weight loss; in 76.2 per cent of the cases diabetes was present. Three of the patients had involvement of the pancreas without any symptoms. Fluctuation in the levels of serum amylase indicated pancreatic disease.

In patients with intractable pain, splanchnicectomy or pancreatic resection should be considered.

Five illustrations, including 1 roentgenogram.

HOWARD L. STEINBACH, M.D.
University of California

Disseminated Calcification of the Pancreas: Report of Two Cases. John H. Kneidel. Ann. Int. Med. **34**: 790–796, March 1951.

Pancreatic calcification is predominantly a disease of middle-aged males, with no characteristic clinical syndrome. The most constant feature is a variable type of epigastric pain, usually dull and continuous in character, with periods of acute colicky exacerbation. Lumbar radiation of the pain is common, and the acute attack is most often confused with gallbladder or renal disease. Steatorrhea with severe diarrhea of bulky fatty stools develops in the well established case, apparently due to a lack of secretion of the pancreatic fat-splitting hormone steapsin. Diabetes is a late and terminal manifestation resulting from destruction of the islands of Langerhans through parenchymal atrophy and fibrosis.

The cause of pancreatic calcification in general remains obscure. It is assumed to be a combination of stasis of secretion in the ducts with bouts of pancreatitis.

At autopsy a fairly characteristic pathologic picture is present. Calcification is found in both the larger and the smaller ducts, with cystic dilatation of these ducts. Foci of calcification may also be seen in the remaining parenchymal tissue. There is atrophy of the parenchymal acinar tissue, with a severe degree of fibrosis.

The diagnosis of pancreatic calcification depends chiefly on the radiologic findings correlated with the

clinical picture. Calcifications are said generally to be located somewhere below a horizontal plane passing through the upper margins of the body of the first lumbar and above a plane through the lower margin of the third lumbar vertebra (Gillies: Am. J. Roentgenol. **41**: 42, 1939). Calcifications may be found above this level but never below it. Since barium in the stomach or colon can obscure the calcifications, scout films in the anteroposterior and lateral projections are essential. The lateral view is important, for the pancreas is a retroperitoneal organ and usually lies 1 to 2 cm. in front of the spine. The tail, however, may curve posteriorly to be situated in the same plane as the vertebral bodies. Another diagnostic roentgen aid is the demonstration of certain alterations in small bowel function, believed to result from associated pancreatic insufficiency.

Two cases of disseminated pancreatic calcification complicated by diabetes and severe pancreatic insufficiency with steatorrhea are reported. One case was followed to autopsy.

In one case, and possibly in both, insulin shock was precipitated by exacerbations of diarrhea. This was apparently due to an increased loss of carbohydrate in the stools and poor intestinal food absorption due to the pancreatic steatorrhea. Diabetes associated with disseminated pancreatic calcification thus constitutes a special problem as far as management is concerned.

The attacks of jaundice which one patient experienced, associated with abdominal colic and diarrhea, are of interest since pancreatic duct calculi can cause obstruction of the bile duct as they become arrested at the ampulla of Vater.

Pancreatic disease must be considered when gastrointestinal, gallbladder and kidney studies have not determined the cause for abdominal symptoms.

Three roentgenograms; 1 photograph; 1 photomicrograph.

STEPHEN N. TAGER, M.D.
Evansville, Ind.

Intra-Abdominal Calcification in an Infant. Report of a Case. Nathan Epstein and Joseph A. Ritter. Gastroenterology **17**: 275–278, February 1951.

In a 3-weeks-old female infant hospitalized because of diarrhea and thrush, a routine roentgenogram of the chest revealed mottled densities overlying the ninth rib posteriorly and in the region of the transverse colon. Because of this unexpected finding, additional examinations were done. A plain film showed scattered calcific densities throughout the abdomen. Roentgen studies of the gastro-intestinal tract, urinary tract, skull, and long bones were negative. At seven months of age, the intra-abdominal calcification was still present. At twelve months it had disappeared.

Intra-abdominal calcification in the newborn has occasionally been noted in association with intestinal obstruction or perforation, peritonitis, and fibrosis of the pancreas. Such a finding has not been previously noted in an asymptomatic infant. It is pointed out that meconium peritonitis may remain sterile, provided the amniotic fluid is not contaminated and the perforation is sealed off. Calcification may begin twenty-four hours after the onset of peritonitis. It is suggested—but only as a matter of conjecture—that such a mechanism might explain the findings in this case.

Two roentgenograms.

RODERICK L. TONDREAU, M.D.
Lincoln, Nebr.

Hepatic Amebiasis: A 20 Year Experience and Analysis of 263 Cases. Michael E. DeBakey and Alton Ochsner. Internat. Abst. Surg. **92**: 209–231, March 1951. In Surg., Gynec. & Obst., March 1951.

This "collective review" is based upon 263 cases of amebic hepatitis and hepatic abscess seen in the Charity Hospital and the Touro Infirmary of New Orleans in a twenty-year period, 1928–1947. All phases of the subject are covered. Concerning the roentgen aspects the authors say:

"Roentgenography is a particularly useful diagnostic procedure in amebic hepatic infections. Characteristically there is observed on fluoroscopic examination elevation and immobility or restriction of motion of the right leaf of the diaphragm. Because involvement of the liver occurs most frequently near the dome and in close contact with the diaphragm, varying degrees of pulmonary and pleural reaction may be observed in the right basal area. In addition to these findings there may be observed, especially in true abscess formation, a distinct bulging of the diaphragm pointing upward into the lower pulmonary field. . . . .

"Roentgenography is of value in differentiating amebic infections of the liver and subphrenic space from those due to other causes. Most pyogenic infections of the subphrenic space result from an infection in the appendix and are located in the right posterosuperior space. Amebic infections, on the other hand, are located generally in the right lobe of the liver and near the dome, somewhat more anteriorly than posteriorly. Accordingly, the roentgenogram in the latter characteristically shows, in the anteroposterior view, elevation of the medial portion of the right leaf of the diaphragm with obliteration of the cardiophrenic angle. In the lateral roentgenogram, elevation is primarily anterior with a tendency toward obliteration of the anterior costophrenic angle. In pyogenic subphrenic infections, on the other hand, there is elevation particularly of the lateral portion of the diaphragm in the anteroposterior roentgenogram and obliteration of the costophrenic angle with a tendency toward obliteration of the posterior costophrenic angle in the lateral roentgenogram. In amebic abscess of the left lobe of the liver, which is relatively uncommon, these findings are not usually apparent and the presence of this type of amebic hepatic involvement is difficult to demonstrate by ordinary roentgenograms. It is possible, however, to demonstrate these lesions roentgenologically following the ingestion of barium. It has been shown that abscesses in this lobe produce characteristic pressure deformities on the barium-filled stomach. The cardia, lesser curvature, and duodenal cap are displaced downward and the lesser curvature assumes a typical crescentic shape."

Of the 225 cases in the authors' series in which roentgen studies were made, 181 (80.5 per cent) gave positive findings. As might be expected, the incidence of positive roentgenologic signs is much higher in abscess than in hepatitis.

Nine roentgenograms; 21 graphs.

HERNIA

Congenital Hernia Through the Dome of the Right Diaphragm in an Adult. Clifford F. Storey and L. D. Kurtz. Am. J. Surg. **81**: 363–367, March 1951.

Right-sided diaphragmatic congenital herniation in adults is a rare condition. The authors describe a case

in a 34-year-old white male with a history of pain in the right upper abdominal quadrant and right anterior chest starting six days previously and increasing in severity, with nausea and vomiting. Respiration had become painful and there had been no bowel movements for two days. Six years previously the patient had been treated conservatively for acute small bowel obstruction.

On physical examination, the abdomen was found to be moderately distended and tympanic throughout, with tympany above the usual area of the liver, which was tender and dull on palpation. The blood and urine showed nothing abnormal.

Radiographic examination of the chest disclosed what was thought to be a very high right diaphragm with interhepato-diaphragmatic interposition of the intestine. A single film of the abdomen showed dilatation of intestinal loops, probably jejunum. A barium enema study revealed complete obstruction of the proximal transverse colon, the position of which was unusually high, suggesting a herniation of the large intestine above the liver.

The patient did not respond to conservative measures and was operated upon. A hiatus, oval in shape with smooth non-adherent edges, was found in the tendinous portion of the dome of the right diaphragm, through which the transverse colon and greater omentum were herniated. Because of distention and adhesions distal to the hiatus the hernia was irreducible. When finally, by enlargement of the opening, the large intestine and omentum were removed from the thoracic cap and restored to the peritoneal cavity, no pneumothorax resulted, indicating that a hernial sac was present (though this was not definitely identified), perhaps impossible, to dissect free from the posterior thoracic wall.

The most unusual aspect of the case lies in the probability that the opening through the right diaphragm was congenital.

Four roentgenograms. FRANCISCO CAMPOY, M.D.
University of Pennsylvania

Hernia Through the Foramen epiploicum Winslowi. S. Wilk and G. E. Züst. Radiol. clín. **20**: 77–82, March 1951. (In German)

A 72-year-old male complained of loss of appetite for six months and of right epigastric distress two and a half to three and a half hours after meals, lasting for four hours. He had lost 20 kg. since the onset of these complaints. The stools did not contain blood. Barium study showed a questionable ulcer-like projection from the mid-portion of the lesser curvature of the stomach. A large sickle-shaped gas collection extended from the duodenum to the approximate region of the cardia or spleen.

Studies with the aid of orally administered barium and barium enema revealed a relative narrowing of the proximal transverse colon. The distal transverse colon was abnormally widened and was apparently contained in the lesser omental cavity behind the stomach when the patient lay on his back. In the prone position there was reduction of this hernia but it recurred when the patient returned to a supine position.

No operation was performed. The general condition of the patient was not consistent with an intestinal perforation.

Five roentgenograms.

GERHART S. SCHWARZ, M.D.
New York, N. Y.

THE MUSCULOSKELETAL SYSTEM

Physiology of the Osseous Circulation. J. Ducuing, P. Marquès, R. Baux, J. Paillé, and R. Voisin. J. de radiol. et d'électrol. **32**: 189–196, 1951. (In French)

Studies of the osseous circulation were made in dogs, human cadavers, and living patients by injecting contrast medium into veins, arteries, and bone marrow.

Morphologically there exists, in the living, a certain opposition between diaphyseal and epiphyseal circulation. The diaphysis is supplied by the nutrient artery, and the veins drain in centrifugal fashion toward the extremities of the bone. The epiphysis is irrigated by numerous arterioles, and is drained at the same level by an important venous system. Nevertheless, the two systems are in functional communication.

Dynamically, certain points of note were also ascertained. The current of blood on leaving the lower part of an extremity flows more rapidly through the diaphysis. Contrary to the classical notion, the rapidity of blood flow through bone is similar to that in other organs.

Eight roentgenograms. CHARLES M. NICE, M.D.
University of Minnesota

Some Aspects of the Physiopathology of the Articulations. Oct. Coquelet. J. de radiol. et d'électrol. **32**: 159–175, 1951. (In French)

The physiopathologic responses of the various tissues in the joints are discussed. It should be recognized that articular physiopathology is inseparable from nervous and muscular physiopathology. The synovium is a histiocytic connective tissue, and for this reason articular pathology is largely that of connective-tissue. Articular cartilage, on the other hand, does not represent a tissue but an organ of determined structure and function. Since the cartilage is deprived of nerves and vessels, it tends to "suffer in silence" and regeneration is impossible. The juxtaposition of synovium, cartilage, and capsule entails particular pathologic possibilities which explain formation of osteophytes.

Five illustrations, including 1 roentgenogram.

CHARLES M. NICE, M.D.
University of Minnesota

Examination of Articulations by Means of Contrast Media. G. F. Leroux. J. de radiol. et d'électrol. **32**: 210–224, 1951. (In French)

The employment of contrast substances in the examination of the articular zone comprises two modalities: arteriography and arthrography. Arteriography has been used but little. Leb has demonstrated an ischemic aspect in the para-articular regions in chronic rheumatic polyarthritis.

Arthrography is an older method. The insufflation of oxygen into the articular capsule was described by Werndorff and Robinson in 1905. The important work of Bircher and Oberholzer (Acta radiol. **15**: 452, 1934), based on 700 arthrographic studies of the knee, established the general value of the procedure in the diagnosis of affections of the soft parts of the knee. In the years that followed, various workers investigated its use in the hip, shoulder, elbow, acromioclavicular joint, temporomandibular joint, wrist, and arch of the instep.

There are three arthrographic methods: gaseous arthrography, opaque arthrography and mixed arthrography.

Gaseous arthrography was the exclusive method from

1905 to 1939. Among the disadvantages of this method, danger of air embolism and the development of persistent synovitis have been mentioned. Occasional cases of benign hydrarthrosis have also been observed. Otherwise very few complications incidental to the use of the procedure are reported. Many small meniscal fissures remained imperceptible until the use of forced abduction and adduction aided in their demonstration. Gaseous arthrography has been used principally in study of the knee.

Opaque arthrography with iodized oil has known only a temporary vogue. The same is true of thorotrast. Water-soluble opaque substances have received the most attention. Uroselectan, abrodil, tenebryl, and diagnorénol require novocaine as an anesthetic. Perabrodil, diodone, and umbradil may be used without local anesthesia. The concentration of the opaque medium is 20 to 35 per cent. Usually 10 to 20 c.c. suffice for the knee. According to Lindblom (Acta radiol. Suppl. 74, 1948) whose experience included 4,000 cases, about 5 per cent of patients experience moderate pain and hydrarthrosis some twelve hours after injection. As opposed to gas, the opaque solution is miscible with fluid in the joint.

The poor contrast given by gas led Bircher and Oberholzer to combine a small quantity (about 3 c.c.) of perabrodil with air—mixed arthrography. Oberholzer also stated that manometric control is desirable; he believed that not over 150 mm. of water pressure should be used in injecting the knee (120 cm. of water for patients over fifty years of age), as pressures of 200 mm. of water place the capsule in danger of rupture. Likewise, the shoulder and elbow do not support pressures over 150 mm. of water.

Leroux uses a modification of Lindblom's technic for opaque arthrography of the knee. After cutaneous disinfection, 10 c.c. of 35 per cent umbradil (diethanolamine salt of 3,5-di-iodo-4-pyridone N-acetic acid) are injected laterally between the patella and femur. An elastic band is placed above the knee, which is then flexed and extended ten times. Five stereographic pairs of films are obtained: (1) anteroposterior; (2) 45-degree oblique with knee inverted and flexed 10 degrees; (3) oblique with knee everted, straight; (4) posteroanterior, with knee flexed at 60 degrees; (5) lateral, with knee flexed at 90 degrees, elastic band removed.

Diagnostic signs are reliable in lesions of the medial and lateral menisci, anterior and posterior cruciate ligaments, capsular tears, bursal enlargements, and in localization of free intra-articular bodies.

Sixteen figures, including 28 roentgenograms.

CHARLES M. NICE, M.D.
University of Minnesota

Contribution to the Roentgen Diagnosis and Differential Diagnosis of Fibrous Dysplasias of the Skeletal System. L. Psenner and F. Heckermann. Fortschr. a. d. Geb. d. Röntgenstrahlen **74**: 265–288, March 1951. (In German)

The authors would group together certain of the fibrous dysplasias which originate from the same underlying cause. These include osteofibrosis deformans juvenilis, osteodystrophia fibrosa unilateralis, unilateral Recklinghausen's disease, polyostotic osteitis fibrosa cystica, fibrocystosis of the skeleton, fibrocystic disease of the calvarium, etc.

The process commences as a central medullary fibrosis in the diaphyses of the long bones and central portions of the flat bones. There is eccentric atrophy of the cortex with replacement of normal bone by fibrotic material, broadening of the medullary cavity, and irregular cortical thinning with areas of bone thickening. The bone shaft is broadened, bending of the bone is often present, and cyst-like areas occur. These changes predispose to fractures, often spontaneous.

Although many theories have been presented, the etiology is by no means clear. Some endocrine disturbance is likely, more particularly parathyroid or adrenal. Albright and his co-workers suggested hypothalamic dysfunction as a probable basis. Trauma is considered important by some authors.

Uehlinger (Virchows Arch. f. path. Anat. **306**: 255, 1940) recognized three types of involvement, monostotic (single bone), oligostotic (few bones), and polyostotic (many bones), and listed the bones affected in the order of frequency, as: femur, tibia, pelvis, humerus, fibula, metatarsals, radius, metacarpals, phalanges, and base of skull. Cases are usually recognized somewhere in the age group of five to fifteen years, but skull asymmetry has been reported as early as one and one-half years of age.

Clinically, the patient may have a spontaneous fracture which heals, usually very well, joint pains without functional disturbance, insomnia, cranial nerve disturbances, and occasionally convulsions. Mental development is normal. Precocious puberty and skin pigmentation are observed in females but not in males.

Skull changes are often unilateral, involving only the base, with considerable bone thickening and areas of rarefaction. The clivus and dorsum sella are involved. The outer table is thin, elevated, and irregular. There may be involvement of the sphenoid wings, the facial bones, especially maxilla and jaw, and occasionally the petrous portion of the temporal. The optic canals or other foramina may be impinged upon.

The bodies, arches, and processes of the spine are involved; epiphyseal plates are often deformed but not eroded. The ribs show irregular cyst-like areas of rarefaction with bone thickening between. In the pelvis, also, there are multiple areas of cyst-like rarefaction and bone thickening, producing skein-like, flecked or ring patterns.

The long bones show cortical expansion and thinning and grossly irregular structure with alternate thickening and rarefaction. Endosteal thickening may completely obliterate the medullary space. There is resulting weakening of bone structure with bending and often pathological fracture. Demarcation between normal and affected bone is frequently sharp; the joints are not directly involved but may show secondary arthritic changes. Similar changes occur in the small bones of the hands and feet.

Hopf (Radiol. clin. **18**: 129, 1949. Abst. in Radiology **54**: 624, 1950) described three types of bone change as observed roentgenologically: sclerosing, "soap bubble" or pseudocystic, and mixed or transitional.

Differential Diagnosis: Paget's disease occurs in older individuals. It is not as frequently unilateral, and in advanced stages general involvement of the skull is the rule. There is usually less involvement of the sinuses and facial bones. The cyst-like formations are in general not so large, and the process does not stop at the suture line, as it occasionally does in fibrous dysplasia.

Meningioma may cause rarefaction by infiltration of tumor cells and thus simulate fibrous dysplasia, but the area of involvement is smaller and more regular, and

radiating spicule formation is often present. Occasionally confusion may arise with cholesteatoma, dermoid, eosinophilic granuloma, myeloma, or hemangioma.

In the vertebral bodies, fibrous dysplasia may closely simulate tuberculosis, but there is never an associated soft-tissue mass. Chondroma of the rib may be somewhat confusing but usually shows more of the typical web-like structures and involves a smaller area. In the long bones, fibrous dysplasia may simulate cystic tuberculosis or other cystic lesions.

In osteitis fibrosa cystica (Recklinghausen) the entire skeleton usually shows osteoporosis and no part is spared, while in fibrous dysplasia the uninvolved portions of the bones show a completely normal pattern. Recklinghausen's disease can be improved by removal of a parathyroid tumor; fibrous dysplasia is uninfluenced.

Malignant change, although rarely seen, may be superimposed on Paget's and Recklinghausen's disease. Thus far there has been no report of such change in fibrous dysplasia.

Thirty-two roentgenograms.

E. W. SPACKMAN, M.D.
Fort Worth, Texas

Polyostotic Fibrous Dysplasia Associated with Hyperthyroidism. Maurice Yettra and Paul Starr. J. Clin. Endocrinol. **11**: 312–321, March 1951.

Polyostotic fibrous dysplasia is a non-familial and non-hereditary condition in which lesions of bone, pigmentation of the skin, and certain endocrine disorders may exist (Albright's syndrome). The most common endocrine dysfunction is precocious puberty in the female. The paucity of reports of complete postmortem examination makes it unwise at the present time to speculate on the pathogenesis of this syndrome. In about 5 per cent of the cases, hyperthyroidism is present, and the authors believe that the relationship between the two conditions is more than coincidental.

Two cases are presented which manifested the typical bony changes and pigmentation of Albright's syndrome and evidence of hyperthyroidism. In neither patient was a history of precocious puberty obtained. Four similar cases from the literature are reviewed.

Eight illustrations; 1 table.

Monostotic Fibrous Dysplasia of Bone. Report of a Case Involving Three Contiguous Ribs Treated by Wide Resection of the Thoracic Cage. F. Miles Flickinger. J. Thoracic Surg. **21**: 298–305, March 1951.

Differentiation of various solitary cystic bone lesions is a problem to the radiologist. Fibrous dysplasia may be confused with osteitis fibrosa cystica, giant-cell tumors, Albright's syndrome, chondroma, eosinophilic granuloma, solitary bone cysts, solitary chloroma, osteoid osteoma, ossifying fibroma, fibrosarcoma, Paget's disease, metastatic new growth, and neurofibroma of bone. Additionally, primary rib tumors may be confused with encapsulated empyema, cold abscess, intercostal nerve tumors, aneurysm, and bronchogenic carcinoma.

Pathologically, monostotic fibrous dysplasia is a benign tumor which may be locally invasive. Such a case is reported. The appearance and behavior of the tumor suggest that it may be a connecting link between benign fibrous dysplasia and osteogenic sarcoma.

A 41-year-old man suffered severe right-sided chest pain while abducting his right arm in a perfectly normal fashion. Swelling occurred in the anterior axillary fold. Five weeks later the swelling was still present and on x-ray examination a tumor of the right fourth rib was distinguished. This enlarged continuously in the next six months, filling the right axilla. The tumor weighed 1,000 gm. after removal. Invaded portions of the third and fifth ribs were included in the excised mass.

Both on radiographic and pathologic examination, a distinct tumor capsule was evident. The capsule was partially calcified.

One roentgenogram; 1 photograph; 1 photomicrograph.

DONALD DEF. BAUER, M.D.
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The Pathological Picture of Melorheostosis (Léri). Two Cases. W. Boecker. Fortschr. a. d. Geb. d. Röntgenstrahlen **73**: 299–305, March 1951. (In German)

The first case of melorheostosis was reported in 1922 by Léri and Joanny. Although a number of cases have since been reported, knowledge regarding the earlier phases of the condition is slight, as symptoms appear only after periosteal changes, and the very early stages are not characteristic roentgenologically. When the process has progressed sufficiently to show characteristic x-ray changes, one finds massive thickening of the bone of the extremity, usually throughout its entire extent, increasing proximally to distally, more marked as a rule on one side. Similar bone thickening may be observed in the shoulder and pelvis. The small bones of the hand and feet are often involved. The bone accretion gives rise to secondary changes, humping and bowing of the shaft, shortening, or occasional elongation, and striping within the bone cortex. Particularly in the pelvis, this striped pattern of increased bone density is arranged in parallel bands, radiating in the direction of the hip joint. Sometimes, spurs project into the soft tissues from the border of the acetabulum (Geschickter and Gottlieb).

Unilateral involvement is rather the rule in early cases, but the author cites 3 examples of bilateral distribution at a fairly early stage of development. A similar type of involvement may occasionally be found in the ribs, the base of the skull, and the vertebral bodies, especially in the lumbar region.

The etiology has never been definitely established; some form of congenital disturbance of segmental development may be responsible. The author believes, from a review of the literature and his own observations, that isolated endostosis, the spotty and striped forms of osteopoikilosis, and melorheostosis should be considered as belonging in the same category, though with different manifestations, and that they may show transition from one to the other.

Two cases are reported, illustrated with 5 roentgenograms.

E. W. SPACKMAN, M.D.
Fort Worth, Texas

Melorheostosis with Bone Sclerosis in Right Upper Quadrant of the Body, Involvement of the Skull, and Skin Changes. W. Höffken and G. Heim. Fortschr. a. d. Geb. d. Röntgenstrahlen **74**: 289–298, March 1951. (In German)

The authors give a detailed description of a 20-year-old man with melorheostosis involving the upper right

quadrant of the body and similar sclerotic changes in the base of the skull, shoulder girdle, and adjacent ribs. Skin changes of the scleroderma type were also present, involving the skin of the chest on the right side. Roentgenograms showed the usual findings plus involvement of the right side of the occipital bone and sphenoid and local thickening in the parietal bone and in the apex of the petrous pyramid. There was enlargement of the carotid canal due to aneurysm. The case is unique in that it is the first for which autopsy findings have been reported.

Distribution of the changes of melorheostosis need not be limited to one member or part of the body; cases have been reported involving all four body quadrants. The similarity of these changes to other bone dyscrasias, particularly osteofibrosis deformans juvenilis or polyostotic fibrous dysplasia, suggests a very close relationship between these conditions. They may be merely different phases of the same congenital underlying defect, with variations in the x-ray appearance and some of the clinical features. On histologic examination of the bones in the case reported, sclerotic changes were present but nothing was observed that could be regarded as typical of the specific disease. It seems extremely unlikely that the sclerosis can be regarded as on the basis of purely vascular changes. In cases thus far observed, there is an arrest of the process as full growth and skeletal maturity are attained.

The conditions considered in differential diagnosis were osteitis fibrosa, osteitis deformans, marble bone disease, various blood dyscrasias, and toxemias. Each had some clinical or radiographic feature of differentiation.

Eight roentgenograms; 1 drawing; 2 photographs; 4 photomicrographs.

E. W. SPACKMAN, M.D.
Fort Worth, Texas

Maffucci's Syndrome (Dyschondroplasia with Hemangiomas): A Case with Early Osseous Changes. J. Fred Mullins and Clarence S. Livingood. Arch. Dermat. & Syph. **63**: 478–482, April 1951.

Maffucci, in 1881, was the first to describe an entity characterized by dyschondroplasia and multiple hemangiomas. Since that time a total of 27 cases have been reported in the literature. Other characteristic features of this syndrome include the following: the disease is non-familial; the patient is usually normal at birth; involvement is unilateral or extremely asymmetric; there is uneven growth of the two sides; the disease is more common in males; its onset is before puberty; there is an associated susceptibility to fractures, and phleboliths are not uncommon in the hemangiomas. Chondrosarcoma was found in approximately 20 per cent of the cases recorded. It occurs particularly in patients with enchondroma, and for this reason the prognosis is less favorable in Maffucci's syndrome than in dyschondroplasia alone.

A case of Maffucci's syndrome in a six-year-old Negro boy is reported. The lesions were known to have been present since birth, but the diagnosis was not made until the child was six years of age. A roentgenogram of the skull was reported as normal except for prominent vascular markings in the right parietal region, which were not thought to be of clinical significance, although one superficial tumefaction was present in this region. In the upper extremities calcification was demonstrable just medial to the upper third of the humerus, in an area which corresponded to the location of a superficial tumefaction; there was definite reduction in the size of the right humerus and the bones of the right forearm, as well as the medullary cavities, as compared with corresponding areas on the left, and there were fewer epiphyses in the right wrist. Roentgen studies of the lower extremities revealed a slight reduction in the size of the left hemipelvis and of the soft tissues of the buttocks; the left femur was longer than the right, with decided bowing. The hemangiomas were removed surgically.

Four photographs.

Vitamin A Poisoning. Donald Gribetz, Samuel H. Silverman, and Albert E. Sobel. Pediatrics **7**: 372–385, March 1951.

Two cases of hypervitaminosis are presented, with typical roentgen findings in the long bones, and the data on 14 previously recorded cases are tabulated. One of the authors' patients had the highest fasting plasma vitamin A level yet reported, the increase being chiefly due to a high vitamin A alcohol fraction. It is believed that this elevated level of alcoholic vitamin A probably denotes large stores of the vitamin in the liver and this value is considered a better index of hypervitaminosis A than the total level. Evidence is advanced that the toxic factor in hypervitaminosis A is the permanent elevated plasma vitamin A level.

Four roentgenograms; 1 graph; 3 tables.

Multiple Myeloma Without Demonstrable Bone Lesions. Robert S. Wallerstein. Am. J. Med. **10**: 325–333, March 1951.

Three patients, all with bone marrow aspirates characteristic of multiple myeloma, presented a variety of clinical pictures and of diagnostic problems. In each, complete x-ray study of the skeleton failed to reveal any clue to the correct diagnosis, showing neither the classical focal punched-out lytic lesions nor the diffuse decalcification sometimes seen. The first patient showed the characteristic but non-specific triad of severe and incapacitating bone pain, progressive anemia and weight loss. These signs, together with the presence of definite Bence-Jones proteinuria and impaired renal function, suggested the proper diagnosis. The second patient complained of progressive anemia, weakness and weight loss, and dysphagia and cheilosis. Anemia of the Plummer-Vinson type, pernicious anemia, liver cirrhosis with avitaminosis, and metastatic cancer were considered. Sternal marrow aspiration, done in order to elucidate the underlying nature of the anemia, revealed the true state of affairs. The complaints of the third patient were anemia and weakness and a weight loss of 71 pounds in one year, but no pain. In this instance more of the abnormalities of protein metabolism popularly associated with multiple myeloma were present and suggested the diagnosis prior to marrow aspiration. Roentgenologic studies showed a lesion of the right fifth rib anteriorly which might be a solitary myeloma, but its position precluded easy biopsy.

In 2 of the patients autopsy subsequently confirmed the diagnosis of multiple myeloma and revealed associated amyloid deposits, particularly in the heart.

Wider use of bone marrow aspiration as a diagnostic tool in patients with obscure anemia, pain, weight loss, etc., would probably result in the recognition of more cases of multiple myeloma.

Paget's Osteitis Deformans in the Early Stage. U. Wetzel and S. Nordmann. Fortschr. a. d. Geb. d. Röntgenstrahlen **74**: 315–320, March 1951. (In German)

Early lesions of Paget's disease involving the skull are seldom seen. The authors present the case of a 56-year-old woman complaining of headaches and facial spasm, double vision, etc. X-ray examination showed a sharply outlined defect of decreased density involving the frontal, parietal, and temporal regions on the right side, with multiple dense irregular calcified areas within. Blood chemistry studies were not characteristic. Calcium and phosphorus were normal, serum phosphatase raised, cholesterol at first elevated and later normal. Symptomatic improvement was noted following deep x-ray therapy but check-up studies in six months showed general progression of the skull lesions and involvement of other bones, especially the femur and ischium bilaterally.

[It is well to keep in mind that osteoporosis circumscripta may be the earliest manifestation of osteitis deformans and that it can be confused with xanthomatosis or metastatic disease. It frequently leads to basilar invagination.—E. W. S.]

Three roentgenograms. E. W. SPACKMAN, M.D.
Fort Worth, Texas

Lead-Poisoning in Children. Report of Five Cases, with Special Reference to Pica. N. F. Elliott Burrows, John Rendle-Short, and Denis Hanna. Brit. M. J. **1**: 329–334, Feb. 17, 1951.

Many cases of lead poisoning in infancy and childhood have been reported but a review of the literature of Great Britain for the past sixty years yielded only 7 case reports. The authors add 5 cases. Four of these were associated with pica (perverted appetite) and one was associated with the use of a lead nipple shield. The serious prognosis of lead poisoning is indicated by the fact that one of the patients died and two are mentally retarded.

The source of the lead in lead intoxication depends largely upon the age of the patient: (1) in infancy, application of powder containing lead to the maternal breasts or infant's skin and the use of lead nipple shields; (2) in children up to five years, ingestion of lead paint or metallic lead objects, due to perverted appetite; (3) in children of school age, great diversity of hazards, the most widely publicized being the burning of battery casings.

The clinical manifestations of chronic lead poisoning in children differ from those in adults in several respects. In adults, the main symptoms are gastrointestinal—colic and constipation. There are also anemia, lead line on the gums, and peripheral palsy. In children, the most important symptoms are those of encephalopathy, which occurs in a large percentage of cases; eye signs are common, while lead line and palsies are rare.

The diagnosis is often first suspected because of punctate basophilia. This finding is not diagnostic but it should lead to further studies, the most important of which is roentgen examination of the long bones.

Roentgenographic changes are almost always present. Opaque bands due to the deposition of lead in abnormally numerous and condensed trabeculae are found at the growing ends of the long bones and at the margins of the flat bones. This finding is not present in adults because lead is deposited only in actively growing bones. Plain films of the abdomen may show specks of radiopaque material (metallic lead or lead salts) in the bowel. In the presence of markedly increased intracranial pressure, roentgenograms of the skull may show separation of the sutures.

Treatment is aimed at immobilizing the lead in the bones. "Deleading" should never be attempted because of the risk of encephalopathy.

Three roentgenograms.

RODERICK L. TONDREAU, M.D.
Lincoln, Nebr.

Contrast Myelography with Emulsified Pantopaque. William A. Nosik. Am. J. Roentgenol. **65**: 374–376, March 1951.

This is a short article setting forth the author's attempts at emulsifying pantopaque (ethyl iodophenylundecylate) for use in myelography. The final product was produced by shaking the oil with spinal fluid which gave an oily mixture with small droplets but not a true emulsion. The oil frequently settled out and gave the usual pictures. In the cases where the droplets remained in suspension, good visualization was obtained.

The author recommends that the search for more stable emulsions of ethyl iodophenylundecylate be continued.

Four myelograms. EVERETT L. PIRKEY, M.D.
University of Louisville

Myelographic Defects of Herniated Intervertebral Discs Simulating Cauda Equina Neoplasms. Abraham Kaplan and A. L. Umansky. Am. J. Surg. **81**: 262–278, March 1951.

The authors present 10 cases of giant herniated intervertebral disks, showing a complete block to pantopaque within the spinal canal, which were suggestive of cauda equina neoplasms. The patients presented symptoms and signs of either bilateral or alternating involvement of the lower extremities. Two showed a "cap" formation on myelography. A high elevation of spinal fluid protein has been associated with spinal cord neoplasms. One of the patients of the present series showed a complete subarachnoid block by manometric test, xanthochromic fluid, and a total protein of 2,200 mg. per cent.

It is recognized that differentiation of far-advanced cauda equina neoplasms from intervertebral disk lesions presents no great difficulty, but if the neoplasm is early it may be difficult to distinguish it clinically from giant intervertebral disk herniation. Myelography is recommended as a method of establishing the presence and position of the lesion and as an aid in the planning of the surgical procedure. A résumé of the interpretation of the myelographic defects as seen in disk herniations is presented.

Twenty-four illustrations, including 14 roentgenograms. CHARLES EBY, M.D.
University of Pennsylvania

Migraine Headache: An Analysis of 124 Cases Treated by Head-Traction Manipulation and Thiamin Chloride. Murray M. Braaf. New York State J. Med. **51**: 528–533, Feb. 15, 1951.

The author seeks to direct attention to the role of trauma to the cervical spine in the production of migraine. In a series of 88 patients with typical migraine, 36 gave a history of trauma preceding the development

of headaches, and 28 others stated that attacks were aggravated after injury. Roentgenographic evidence of loss of the lordotic curve of the cervical spine was obtained in 34 cases. There was similar loss of the lordotic curve in 28 of 36 cases of atypical migraine. It is considered "highly significant" that such a large number of patients (39 per cent with classic migraine and 78 per cent with atypical disease) "showed definite roentgenographic changes characteristic of disk lesions." [Myelograms were not obtained, however, to demonstrate actual disk protrusion.] In all cases there was definite localized tenderness to pressure in the upper cervical spine on the same side as the headache.

The author claims to have obtained substantial relief in some 70 to 80 per cent of his series of cases by head-traction-manipulation and thiamin chloride. The addition of thiamin chloride to the manipulation makes the evaluation of the results difficult, since Palmer, whom he quotes (Clinics **4**: 531, 1945), obtained relief in 65 per cent of a large series in which thiamin chloride was used, presumably without treatment to the spine. [Also, it must be remembered that psychiatrists claim good results from psychotherapy alone.]

Three roentgenograms; 2 tables.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Spinal Tumors Diagnosed During the First Year of Life, with Report of a Case. William H. Mosberg, Jr. J. Neurosurg. **8**: 220–224, March 1951.

A spinal tumor in a five-month-old male infant is reported. When the patient was first seen at the University Hospital (Baltimore, Md.) physical examination showed a flaccid paralysis of both lower extremities with some motion retained in the toes. The deep tendon reflexes, normal in the upper extremities, were hypoactive in the lower extremities, with sustained ankle clonus on the left and unsustained ankle clonus on the right.

Roentgenograms of the chest and abdomen and intravenous pyelograms were normal. Roentgen examination of the spine showed minimal dilatation of the spinal canal at the level of the 12th thoracic and 1st lumbar vertebrae.

Lumbar puncture disclosed a complete subarachnoid block with yellow fluid containing 1 lymphocyte and 4 plus globulin. The fluid clotted on standing. Because of uncertainty as to the sensory level, pantopaque myelography was performed. This demonstrated a complete block, the lower end of which was between the 1st and 2d lumbar vertebrae. Following this procedure the infant became completely paraplegic.

At laminectomy an extradural, reddish-brown, granulomatous tumor was removed. It was of low vascularity and friable, encircling the dural sac but lying predominantly dorsally and on the left side. The microscopic diagnosis was myelocytoma (lymphocytoma). In view of this finding, bone-marrow studies were done, and were thought to be compatible with lymphatic leukemia.

The patient made an excellent recovery and when last seen, sixty-five days after the operation, showed no signs of neurologic disorder.

The data on 23 previously recorded cases in which an intraspinal tumor was diagnosed during the first year of life are tabulated.

Two roentgenograms.

Protrusio Acetabuli (Otto-Chrobak Pelvis). Its Pathogenesis and Roentgen Symptomatology. F. Klopfer. Fortschr. a. d. Geb. d. Röntgenstrahlen **74**: 323–328, March 1951. (In German)

Protrusio acetabuli consists typically of central protrusion of the femoral head into the acetabulum, with deepening of the cavity and consequent bulging into the pelvis. The underlying cause may be a congenital developmental defect, since in many cases there is symmetrical involvement on both sides and often no immediate cause is apparent. Usually, the earlier stages are observed at or about puberty. It is believed that some form of growth disturbance incident to puberty and weight-bearing may be factors. Trauma and local inflammatory changes undoubtedly play a part in some cases. A certain family tendency is recognized, but a definite hereditary tendency has never been established. Three typical cases are presented.

The first patient was a 35-year-old woman with low back pain since the age of seventeen. The condition was found during a urological survey. X-ray examination showed a thin acetabular floor bilaterally, with protrusion of both femoral heads toward the midline and some measure of reactive sclerotic change, especially on the right. General pelvic architecture was undisturbed.

Case 2 is that of a 50-year-old woman with marked reactive thickening and deepening of the acetabulum on the left with sclerotic changes. The right hip showed the results of an old injury, at the age of fourteen, with acetabular erosion, false joint formation, and extensive absorption of the femoral head and neck. This type of case illustrates the effect of overweight on the left side, compensating for the involvement on the right, in contrast to the previous case in which there were no similar mechanical factors.

The third patient was a 42-year-old woman, showing unilateral protrusion, the result of previous inflammatory disease over a period of many years. Extensive sclerotic reaction was present, with narrowing of the joint space and spur formations about the joint borders indicating arthritic change.

The author feels that protrusion of the acetabulum may be classified into two groups: (1) an idiopathic type, which is bilateral, is more frequent in females, and occurs at or about puberty; (2) an acquired type, most often unilateral, showing considerable reactive sclerotic change.

Four roentgenograms. E. W. SPACKMAN, M.D.
Fort Worth, Texas

Bipartite Os Lunatum. Pierre Eggimann. Radiol. clin. **20**: 65–70, March 1951. (In German)

The bilateral occurrence of a bipartite os lunatum is reported in a 7-year old girl and her 9-year-old brother. Various developmental theories which might explain this finding are discussed. The author concludes that its derivation from two ossification centers or from the formation of an unusually large epilunatum is one and the same process.

Eight roentgenograms.

GERHART S. SCHWARZ, M.D.
New York, N. Y.

Calcareous Tendinitis of the Flexor Carpi Ulnaris. Alexander P. Aitken and H. Kelvin Magill. New England J. Med. **244**: 434–435, March 22, 1951.

The clinical picture produced by calcific deposits

adjacent to or within the flexor carpi ulnaris at its insertion into the pisiform bone on the volar and ulnar surface of the wrist joint is described. Two cases are used for illustration. Acute symptoms include muscle spasm, swelling, redness and local heat, in addition to the acute pain. Symptoms usually subside within a week and disappear in two to four weeks.

X-ray films taken at the time of onset usually show a calcified mass with well defined outlines. The calcification can be seen to begin disintegrating within a few days and may completely disappear within two weeks.

Splinting, heat, and penicillin were used for treatment in the cases reported.

Five acute cases and one chronic case have been seen by the authors.

Four roentgenograms.

JOSEPH P. TOMSULA, M.D.
Baton Rouge, La.

Giant Cell Tumors of Tendon Sheath Origin. A Consideration of Bone Involvement and Report of Two Cases with Extensive Destruction. A. G. Fletcher, Jr., and Robert C. Horn, Jr. Ann. Surg. **133**: 374–385, March 1951.

Forty-three cases of giant-cell tumor of tendon sheath origin from the Laboratory of Surgical Pathology of the Hospital of the University of Pennsylvania were reviewed. Opinion is divided as to whether these represent true neoplasms, granulomatous reaction to an undetermined stimulus, or the product of metabolic imbalance. The authors state that these tumors have a characteristic histologic picture differing from giant-cell tumors of bone chiefly in having an eosinophilic stroma or ground substance. Many of the other differences are qualitative.

Of the 16 cases in which preoperative roentgenograms (or reports thereof) were available, 7 showed evidence of bone abnormality. Three instances of extensive bone destruction and four instances of bone erosion are mentioned. The bony changes are those of erosion due to pressure; the expanded marrow and thinned cortex of the giant-cell tumor of bone are not observed.

Three-fourths of these lesions occur in the upper extremities, usually on the fingers. Treatment is excision, with amputation when there is bone involvement. Local recurrences follow excision in about 12 per cent of the cases. The authors relate this to invasion of the capsule or tendon sheath, which they found in 30 of their 43 cases.

Two cases showing bone destruction are reported.

Five roentgenograms; 13 photomicrographs; 1 photograph; 2 tables. GEORGE R. KRAUSE, M.D.
Cleveland, Ohio

OBSTETRICS AND GYNECOLOGY

A Preliminary Evaluation of Cave's Roentgenographic Method of Fetal Cephalometry. Thomas W. McElin, Sim B. Lovelady, Robert W. Brandes, James S. Hunter, Jr., and C. Allen Good. Am. J. Obst. & Gynec. **61**: 487–497, March 1951.

The authors devote some space to a review of the literature concerning roentgen methods of cephalometry, following which they present an analysis of 22 unselected cases in which they used Cave's method, the only qualifications being that the patient be in early labor and the fetus in vertex presentation. Views were centered over the pelvic inlet, with two different tube distances, with the patient in the anteroposterior recumbent position with a support under the lumbar spine.

It was found that with simple inspection of the roentgenograms it was possible to predict roughly how satisfactorily the diameters of the fetal skull could be measured in any given case (*i.e.*, how satisfactory the roentgen visualization of the particular diameter was). The films were divided into four classes, A, B, C, and D, according as they gave a good, fairly good, fair, or poor view of any given diameter. Of films of class A (well visualized diameter of the fetal skull), 83 per cent were within ±5 per cent of the actual measurement of the skull after delivery. In 92 per cent the measurement was within 5.5 per cent of the actual. The largest error was 7.8 per cent. In class D cases, only 30 per cent of the diameters were measured within 5 per cent of the actual diameter, and the largest error was 20 per cent. A total of 45 diameters were measured in the 22 cases studied. Twelve were classified as grade A, 12 as grade B, 11 as grade C, and 10 as grade D.

The authors feel that if they exclude the grossly unsatisfactory roentgenograms, accurate measurements to within 6.6 per cent can be achieved in about 85 per cent of cases by the method employed. They believe it to be worthy of further investigation but make no claim of precision for it. They think it unreasonable to expect extremely high degrees of accuracy in any method of roentgen cephalometry and point out the immeasurable variables in obstetrics which might negate any system of prediction based on precise measurement.

Four roentgenograms; 2 drawings; 4 tables.

T. FREDERICK WEILAND, M.D.
Jefferson Medical College

THE GENITO-URINARY SYSTEM

Intravenous Nephrography: A Method of Roentgen Visualization of the Kidney. H. Stephen Weens, Herbert M. Olnick, David F. James, and James V. Warren. Am. J. Roentgenol. **65**: 411–414, March 1951.

The authors discuss a method of contrast visualization of the kidney parenchyma by rapid intravenous injection of 50 c.c. of 70 per cent diodrast followed at proper intervals by a rapid series of roentgenograms.

In 29 of 35 patients (83 per cent) a satisfactory degree of opacification was obtained. Beginning opacification was noted from nine to twelve seconds after injection and maximum contrast usually occurred at fifteen to eighteen seconds. Often the aorta and larger arteries of the abdomen could be clearly defined before maximal opacification of the kidneys was noted.

The authors think that the method will prove of value in physiologic studies of the renal circulation and in the differential diagnosis of renal and extrarenal masses. They also point out that this procedure is relatively simple compared with other methods of obtaining contrast visualization of the kidney, such as obstructive nephrography or direct aortography.

Four roentgenograms. WILLIAM H. SMITH, M.D.
University of Louisville

Evaluation of the Surgical Kidney Employing Translumbar Aortography. A. Keller Doss and Humberto A. Quirarte. Urol. & Cutan. Rev. **55**: 134–141, March 1951.

Radiographic visualization of the arterial tree of the kidney will give considerable anatomical and physiologi-

cal information in preoperative evaluation of the "surgical" kidney. Renal arteriography does not replace other methods of investigation of the upper urinary tract, but is simply another procedure for obtaining further information on the status of the kidneys.

Some of the features to be observed in the arteriograms are: the relative size of the two renal arteries, arterial duplication, the position of the renal arterial tree in relation to the surrounding structures, and the patency and number of the small vessels extending out into the renal parenchyma. In general, surgical removal of the kidney is indicated if there is occlusion of the main arterial tree; if there is an appreciable reduction in the number of the larger intrarenal vessels; if there is an absence of the smaller intrarenal vessels; or, occasionally, if there is a relative lack of arterial supply except through aberrant vessels.

The authors present 9 cases of various "surgical" diseases of the kidney in which renal arteriograms helped them in determining whether a kidney should be removed or preserved.

Twenty-four roentgenograms.

DEAN W. GEHEBER, M.D.
Baton Rouge, La.

Diagnosis of Involvement of Inferior Vena Cava in Renal Neoplasms. P. A. Duff and W. H. Granger. J. Urol. **65**: 368–370, March 1951.

Extent of involvement of the inferior vena cava in cases of renal neoplasms can be demonstrated roentgenologically without undue risk to the patient by the rapid injection of 35 per cent diodrast solution into the femoral vein and exposure of a film of the abdomen during the injection.

Edema of one or both legs occurring at some time during the course of the disease is the most common clinical sign associated with thrombosis of the inferior vena cava. Collateral circulation is often difficult to evaluate clinically, but is well shown on vena cavograms. Accurate diagnosis of this condition will be of benefit in evaluating operability.

Three roentgenograms.

ALLAN K. BRINEY, M.D.
University of Pennsylvania

Retrocaval Ureter: Report of Four Cases and Review of Literature. John E. Heslin and Christopher Mamonas. J. Urol. **65**: 212–222, February 1951.

The authors found 40 cases of retrocaval ureter reported in the literature since Hochstetter's original description of this anomaly. Of these, only 18 cases were observed antemortem, 12 being discovered at surgery and 6 diagnosed preoperatively. The remaining cases were seen postmortem. The authors add 4 cases, of which 3 were proved surgically and a fourth diagnosed by pyelographic evidence only.

Retrocaval ureter is a congenital anomaly of the venous vascular tree resulting in an abnormal course of the ureter so that it passes behind the vena cava, partially encircles it, and then continues on into the pelvis. The anomalous development of the post-, sub-, and supracardinal venous system may give four different types of retrocaval ureter in man. These are: (1) bilateral postcaval ureters, (2) right-sided postcaval ureter with a single vena cava (the most common type), (3) right-sided postcaval ureter with a double vena cava, both on the right side, and (4) right-sided postcaval ureter with bilateral venae cavae.

Clinically the symptoms and signs are those of obstruction, sometimes accompanied by infection or stones. All operated cases have had hydronephrosis, which is the reason for surgery, and although the symptoms are not pathognomonic, this condition should be considered in all cases of right-sided hydronephrosis.

Roentgen examination with the aid of opaque catheters and ureteropyelography offer the most precise method of diagnosis. Anterior ureteropyelography reveals hydronephrosis with a very long proximal segment of the ureter involved. In addition, the ureter is dislocated medially to or beyond the midline, beginning at the third, fourth, or fifth lumbar vertebra. The resultant redundancy from obstruction and hydronephrosis produces a characteristic hook, and a distinct sickle shape or S-curve is imparted to the ureter. After it has passed around the cava, the course down into the pelvis and the caliber are normal. In oblique and lateral views the retrocaval ureter hugs the spinal column instead of falling away from it.

Nephrectomy is recommended in advanced cases of hydronephrosis but plastic procedures with correction of the anomaly are indicated in the cases with a partially damaged kidney.

Four cases are reported by the author. Two patients underwent nephrectomy because of severe hydronephrosis, although in one of these the diagnosis of retrocaval ureter was not made preoperatively. Another patient refused treatment. The x-ray studies were absolutely pathognomonic of retrocaval ureter. A plastic procedure was carried out upon the last patient and an eight-year follow-up revealed the right kidney to be in excellent functioning condition. It is the opinion of the authors that this entity should be treated as any other congenital anomaly and that surgical intervention is indicated only where definite obstruction, stasis, infection, hydronephrosis, etc., are present.

Six roentgenograms; 1 drawing.

LOUIS PALLES, JR.
University of Pennsylvania

Post-Caval Ureter: A Case Pre-Operatively Diagnosed with Confirmation at Surgery. A. W. Middleton. Rocky Mountain M. J. **48**: 186–190, March 1951.

The author reports a case of retrocaval ureter, in which the diagnosis was made preoperatively and confirmed at surgery.

This condition is due to an abnormal vascular development rather than a renal abnormality. During fetal life, as the kidney ascends from the pelvis, it passes through a ring of veins. Normally, the postrenal portion of the inferior vena cava arises from the dorsal limb of the ring, the ureter lying in front of the vena cava. If the ventral limb rather than the dorsal limb persists, the ureter will lie retrocavally.

The patient was a 31-year-old male whose only significant complaint was recurrent mild right lower quadrant pain over a period of about ten years. In August 1947, the patient suffered the first episode of severe right lower quadrant pain; there was no associated abdominal regidity or tenderness. Urinalysis showed three red blood cells per high power field. The right ureter was catheterized; a sense of obstruction was met at the 25-cm. mark and at 30 cm. there was flow of bloody urine, with immediate relief of pain. Four hours later the pain returned and the ureter was again catheterized. This time there was complete obstruction

at the 25-cm. mark. Pyelography, both retrograde and intravenous, revealed a moderately dilated pelvis from which the ureter coursed medially to overlap the body of the second lumbar vertebra. It then took a normal course to the ureterovesical junction. A diagnosis of retrocaval ureter was made and the patient was operated upon. The postcaval segment was but 2 cm. long and constricted. The ureter was transected above and below this segment and anastomosed around a rubber catheter. Stenosis at the site of union caused rapid renal deterioration, requiring nephrectomy three months after ureteral anastomosis.

Two roentgenograms; 2 drawings.

BERTRAM LEVIN, M.D.
Chicago, Ill.

THE BLOOD VESSELS

Congenital Vascular Anomalies. Acors W. Thompson and June C. Shafer. J. A. M. A. **145**: 869–875, March 24, 1951.

Congenital anomalies of blood vessels of all kinds are discussed and illustrated by case reports. Some of these anomalies occur in association with definite syndromes (Parkes Weber, Sturge-Weber, von Hipple-Lindau, etc.), but essentially the pathology is the same: the vessels involved are enlarged, tortuous, and irregular, whether they are arteries, veins, or capillaries. The important feature in any of these anomalies is the presence or absence of arteriovenous fistulae. If present, they can lead to hypertrophy of an extremity, increased skin temperature, increased venous pressure and oxygen tension in the venous blood. In some cases the fistula conducts so much of the arterial blood that the nutrition of the extremity suffers distal to the lesion. The increased venous pressure contributes to the anoxia by causing stasis in the distal veins.

Arteriography or phlebography will usually outline the abnormal vessels and communications. Measurements of skin temperature and venous oxygen saturation and venous pressure are other helpful diagnostic aids.

Clinically the vascular anomalies can be grouped rather simply as follows: 1. Arterial aneurysm. 2. Phlebectasia. 3. Nevus flammeus. 4. Arteriovenous fistula. 5. Combinations of any or all of the above.

Four roentgenograms; 1 photograph; 4 tables.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Anomalous Pulmonary Veins. J. Chandler Smith. Am. Heart J. **41**: 561–568, April 1951.

The author gives the history of a white male infant who lived eight weeks, adding the autopsy findings. No veins entered the left auricle. Single veins issued from the upper and lower lobes of the left lung and joined to form a common channel, which received a large single vein from the lower lobe of the right lung. This common venous trunk emptied into the pulmonary vein which issued from the upper lobe of the right lung, and the latter vessel then directed all venous blood from both lungs into the superior vena cava close to its entrance into the right auricle.

Anomalous drainage of the pulmonary veins is rare and may be diagnosed by angiocardiography or cardiac catheterization. There are 133 recorded cases in the literature. They are of three types: (1) drainage of some of the pulmonary veins into the right auricle or its tributaries; (2) drainage of all of the pulmonary veins into the right auricle or the veins leading into it; (3) same as (2), with associated anomalies of the cardiovascular system.

Seventy-five cases are recorded of partial drainage of pulmonary veins into the right auricle or its tributaries. In 35 of these, drainage was into the superior vena cava, in 18 into the right auricle, and in 16 into the left innominate vein. Less common sites included the coronary sinus, the inferior vena cava, the azygos vein, and the left subclavian vein.

Thirty-three cases of complete drainage into the right auricle or its tributaries without associated cardiovascular anomalies are recorded, including the author's. In 9 cases the pulmonary veins emptied into the superior vena cava, in 7 into the coronary sinus, in 6 into the right auricle, in 3 into the left innominate vein, in 2 into the portal vein. In 1 case each, all the veins emptied into the inferior vena cava, the portal vein, and the ductus venosus.

There are 23 reported cases with complete drainage of pulmonary veins into the right heart with associated cardiovascular anomalies. The additional anomalies were: cor biloculare, defects of the interauricular and interventricular septa, transposition of the great vessels, cor triloculare biatrium, and atresia of the pulmonic artery and aorta. The structures into which the anomalous pulmonary veins drained included the right auricle, the superior vena cava, the portal vein, and a persistent sinus venosus.

Classification was precluded in 2 cases reported in the literature because of insufficient data.

Partial drainage of pulmonary veins into the right atrium is consistent with long life. Among 56 reported cases of *complete* drainage into the right atrium, however, there were only 10 survivals beyond the age of eight months. There is no circulatory impairment during intra-uterine life. Following birth, oxygenated blood can reach the systemic circulation only through the foramen ovale or the ductus arteriosus. With the closure of the ductus and the foramen ovale death ensues.

This condition is simulated clinically by pulmonic stenosis and interauricular septal defect.

Two drawings; 1 photograph; 3 tables.

HENRY K. TAYLOR, M.D.
New York, N. Y.

Report of Two Cases of the Anomalous Origin of the Right Subclavian Artery from the Descending Aorta. W. C. Sealy. J. Thoracic Surg. **21**: 319–324, March 1951.

The aberrant right subclavian arises from the posteromedial aspect of the first part of the descending aorta and in most cases runs posterior to the esophagus, though it may pass between the esophagus and trachea or even anterior to the trachea. Two cases of this anomaly are reported.

The first patient was a 19-year-old male with adult coarctation of the aorta. Blood pressure was elevated in the left but normal in the right arm. In view of the normal position of the aorta, this discrepancy in blood pressure could be explained only by the origin of the right subclavian artery below the stricture. This was confirmed by the demonstration of typical indentations in the esophagus following a barium swallow.

The second case is that of an 18-month female with wheezing cough, dyspnea, and fever in recurrent epi-

sodes. Roentgen studies showed the right lung more radiolucent than the left, displacement of the lower trachea to the left, and mediastinal shift to the right on inspiration. The right stem bronchus was elevated, angulated sharply, and displaced to the left. The upper and middle lobe bronchi did not fill. The esophagus was shifted dextrally and a pressure defect appeared along its left border in the mid third. The posterior border of the esophagus was slightly indented. Exploration disclosed that the right subclavian arose from the descending aorta at the site of attachment of the ligamentum arterosum. The trachea and the origin of the right stem bronchus were caught between the ascending and descending aorta. Ligation of the right subclavian permitted the descending aorta to retract and free the trachea from the aortic grip.

Three roentgenograms; 4 drawings.

DONALD DEF. BAUER, M.D.
St. Paul, Minn.

Dissecting Aneurysm of the Abdominal Aorta Simulating Renal Disease: A Case Diagnosed Ante-mortem. Henry A. Kontoff and Bernard R. Sears. J. Urol. **65**: 364–367, March 1951.

The authors review the clinical picture of rupture of a dissecting aneurysm of the aorta and present a report of a case diagnosed antemortem.

Rupture of a dissecting aneurysm of the abdominal aorta must be differentiated from urinary lithiasis, perinephric abscess, infarct of the kidney, and renal tumor. The most common etiology is arteriosclerosis. Signs and symptoms include sudden pain in the upper abdomen, flank, or midback, not yielding appreciably to the ordinary opiates; faintness, pallor, and increasing anemia which do not improve with repeated blood transfusions; a mass in the loin, with pulsation and a bruit; urographic changes. Excretion of diodrast may be impaired as a result of renal ischemic anoxia or interference with urinary drainage by direct pressure of the hematoma on the pelvis or ureter. Often there is obliteration of the psoas shadow. Depending on the quantity and distribution of the blood clot, the kidney may be rotated on its vertical or transverse axis and displaced laterally, upward, or downward. There may be haziness or irregularity of the calyceal, pelvic, or ureteral outline because of the blood clot. With a slow leak, life may go on for weeks or months but if the rupture is a large one death occurs in two to six days.

The authors present a case in which the diagnosis was suspected radiographically from the marked lateral displacement of the upper two-thirds of the left ureter and the upward and lateral displacement of the kidney. The calyces and pelves of both kidneys were normal. The diagnosis was confirmed at necropsy.

Two roentgenograms.

NORMAN JULES WINSTON, M.D.
University of Pennsylvania

A Method of Dealing with Arteriosclerotic Popliteal Aneurysms. Joseph M. Janes and John C. Ivins. Surgery **29**: 398–406, March 1951.

Popliteal aneurysms should be looked for in any patient with symptoms usually attributed to arteriosclerosis. The diagnosis having been made, removal of the aneurysm following lumbar sympathectomy is indicated.

Clinical signs include (1) a globular pulsating tumor, (2) thrill and systolic murmur, (3) congestion and edema of the parts beyond, (4) pain and disturbances of sensation, and (5) erosion phenomena. Routine films will often show the presence of an arteriosclerotic aneurysm, but arteriography gives more accurate information. In a case seen by the authors, the latter procedure proved that the clinical diagnosis of aneurysm was wrong, the artery being actually displaced by a calcified mass.

The authors' innovation in treatment is to do both lumbar sympathectomy and extirpation of the aneurysm with the same anesthetic, instead of allowing an interval of ten days between the two procedures. Equally good results were obtained by this method.

Four roentgenograms; 4 photographs; 2 tables.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

The Deep Vein Valves. A Venographic Study in Normal and Postphlebitic States. Josephus C. Luke. Surgery **29**: 381–386, March 1951.

Retrograde venography of the femoral and saphenous venous systems was performed in 52 cases, in some by direct needle puncture and in the others by placing a catheter in the stump of the saphenous vein after ligation, the patient straining before each exposure.

In 3 patients with slight chronic leg enlargement and complaints of aching and tiredness on standing for prolonged periods, retrograde venography showed a valveless common and superficial femoral vein and a decreased number of valves in the femoral tributaries.

In 12 patients on whom retrograde venograms were obtained during the course of high ligation of the great saphenous for varicose veins the valves were found to be incompetent in varying degrees, though no symptoms or signs were present to indicate abnormalities of the deep veins.

Thirty-two patients with a history of previous deep thrombophlebitis were seen with typical postphlebitic complications. In 10 of these cases the femoral vein could not be found by venipuncture. Surgical exploration in 4 of the number showed a fibrous cord with a few small areas of recanalization. In 22 cases, valvular incompetence with various degrees of deep vein deformity, collateral dilatation, and saphenous varices were demonstrated. Since complications were equally severe in those in whom the vein was occluded and in those in whom it remained patent, the author concludes that femoral ligation is not a rational procedure in treating postphlebitic complications. He relies on a program of care of the skin and prevention of stasis (rubber stockings, elevation of leg at rest, etc.).

Eight roentgenograms.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Causes of Failure of Suprarenalectomy and Ganglionectomy in Thrombo-Angiitis Obliterans on the Basis of 898 Operations. René Leriche. Angiology **1**: 432–437, October 1950. (Translated from Presse méd. **57**: 539, June, 15, 1949.)

The author and his associates have performed about 800 ganglionectomies with and without splanchnic section and 98 suprarenalectomies for thrombo-angiitis obliterans. Excellent results are being obtained with increasing frequency, but some cases end in failure despite one or the other of these two procedures, or even the two combined. Lack of success in some cases is no doubt due to the long duration of the disease and the

extent and multiplicity of the localizations; in others it is perhaps attributable to some endocrine disturbance other than suprarenal.

Setting aside obscure reasons, failures are usually due to a definite cause, notably, (1) persistence of an infected ulceration; (2) an extensive thrombosis, with the main route not restored at a distance from the beginning of the obstruction; (3) thrombosis which is at the same time both arterial and venous. With proper treatment, failure is preventable in the patients with ulcerations. In cases with both arterial and venous thrombosis, nothing can avert gangrene. The only aim in such cases is to limit it by abolishing the vasoconstrictor phenomena at the limit of the dead part. The author considers at greater length the condition of the arterial pathway, pointing out that the functional prognosis of operations in thrombo-angiitis obliterans can be demonstrated in advance by arteriography, which permits one to foresee the quality of the result by showing the location and the physiological consequences of the thrombosis. When arteriography reveals that, below a thrombosis, the principal arterial route is not restored, the outlook is not favorable. When, on the other hand, the reutilization of the main channel and its permeability are demonstrable, the prognosis is good. All operations are successful: suprarenalectomy, ganglionectomy, arteriectomy. Vasodilation of the collateral pathways increases the output in the main route and consequently to the extremity.

Four roentgenograms.

Studies of the Portal Venous System by Injection Technique. R. O. Holmes and W. V. Lovitt. Gastroenterology **17**: 209–223, February 1951.

The authors describe a method for demonstration of the intrahepatic and major extrahepatic branches of the portal venous system by injection of a barium sulfate suspension followed by roentgenologic study of the specimen.

The alterations of the portal venous bed and demonstration of collateral vessels at the lower end of the esophagus are reported in 7 patients who had died with cirrhosis of the liver. Five patients who had died without evidence of liver disease served as controls.

The specimens are prepared as follows: the organs are removed en bloc, employing a procedure similar to the evisceration technic of Rokitansky. The block of tissue to be studied includes the esophagus, stomach, duodenum, pancreas, spleen, liver, attached mesentery, and retroperitoneal tissue. After the blood has been washed from the veins, the barium suspension is injected into a major branch of the superior mesenteric vein and roentgenograms of the specimens are made.

The films of cirrhotic livers show a decrease in the size of the major branches and a diminution in the number of tertiary and quaternary branches. In 6 of the 7 patients with cirrhosis there was an increase in the size of the submucosal veins at the root of the esophagus, although only 3 of the patients had a history of hematemesis. One patient without varices had a large shunt connecting the splenic vein with the caval system. Development of collaterals at other sites, including anastomoses between the splenic capsule and lateral body wall, is also demonstrated.

The accompanying illustrations (15 roentgenograms) are striking. One table.

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Lincoln, Nebr.

CONTRAST MEDIA

Effect of Barbiturates and Other Drugs on Mortality from Diodrast in the Mouse. H. Haskell Ziperman, Richard R. Hughes, and Harris B. Shumacker, Jr. Angiology **1**: 427–431, October 1950.

In recent years the use of intravascularly administered radiopaque substances has greatly increased. The ones most commonly employed are protein-bound preparations such as diodrast; thorium dioxide has been used less frequently.

While the administration of diodrast and the related iodide preparations is relatively safe, a number of mild reactions, some severe reactions, and even an occasional death has been reported. These deaths have been attributed either to an anaphylactoid reaction or to colloidal shock.

The authors have investigated fatal reactions to diodrast in the mouse with particular reference to any beneficial influence of drugs or anesthetics upon toxicity. All injections of diodrast were given intravenously into a tail vein, in a dose of either 3,000 or 6,000 mg. per kilogram of body weight in a 35 per cent solution. All other medication, with the exception of procaine, was given intraperitoneally in such a concentration that the total volume did not exceed 0.5 c.c.; procaine was administered intravenously.

Nembutal, barbital, seconal, and evipal were all found to decrease the incidence of immediate deaths following the intravenous administration of diodrast in mice. Barbital, and nembutal in repeated dosage, appeared to lower significantly the over-all mortality.

Ether anesthesia, morphine, benadryl, and intravenously administered procaine hydrochloride did not alter the fatal outcome following the administration of diodrast.

Studies in mice following renal exclusion confirmed the clinical impression that diodrast is more hazardous in the presence of significant impairment of renal function.

RADIOTHERAPY

Irradiation of the Normal Human Hypophysis in Malignancy: Report of 3 Cases Receiving 8,100–10,100 r Tissue Dose to the Pituitary Gland. Keith H. Kelly, Eggert T. Feldsted, Reynold F. Brown, Paul Ortega, Howard R. Bierman, Bertram V. A. Low-Beer, and Michael B. Shimkin. J. Nat. Cancer Inst. **11**: 967–983, April 1951.

Certain malignant neoplasms of man, particularly carcinoma of the prostate and of the mammary gland, are under some degree of control by the endocrine secretions of the host. Partial regression of such neoplasms is achieved by such measures as castration or administration of steroid hormones. The possible role of endocrine influences in malignant melanoma is also suggested by the intriguing observation that this tumor is rarely malignant before puberty and is not observed in castrated individuals.

There has been much speculation as to the action of the hormones in inhibiting these carcinomas. One possibility is that the action is exerted through alteration in

pituitary function. In view of this, the authors attempted to reduce pituitary function in 3 cases of advanced neoplastic disease by irradiation of the pituitary gland. An apparatus was constructed which permitted irradiation of the gland through multiple small fields of entrance. The patient's head was fitted into a plaster-cast skull cap surmounted by a plate into which a bolt was incorporated. The bolt was adjusted to be in the axis of the pituitary fossa and attached to a frame projecting from a standard x-ray machine base plate. The x-ray beam was adjusted to be perpendicular to the axis of the bolt, and passed through the pituitary fossa at any position of the head rotating around the bolt axis. Repeated radiographic examinations showed that the position of the beam relative to the sella turcica did not vary more than 1 mm. for any field of entrance after initial adjustment had been made. The physical factors of irradiation were 200 kv.; 1.2 mm. Cu h.v.l.; field 2.5 cm. in diameter; tube target-pituitary distance 63 to 70 cm. Daily doses of 400 r, measured in air, were given to one, two, or three fields daily. Surface depth and exit doses were determined for each portal, with a presdwood phantom as well as a human skull filled with rice.

All three patients had complete clinical studies performed before, during, and after the completion of irradiation of the pituitary gland. The cases were as follows: (1) disseminated adenocarcinoma of the right breast in a 60-year-old woman; (2) disseminated melanoma in a 38-year-old woman; (3) disseminated bilateral adenocarcinoma of the breast in a 59-year-old woman. Complete case histories are given in the article.

A dose of from 8,100 to 10,000 roentgens was given to the pituitary of each of these patients in a period of two months. They withstood the irradiation well and without untoward reactions. One patient is living one year after the treatment; the others died at three and four and a half months after completion of irradiation. No clinical or laboratory evidence of hypopituitary function was noted. The growth of the neoplasms was not affected. Both women with mammary carcinoma responded to androgens following the completion of pituitary irradiation. Gross and microscopic examination of the pituitary gland and other endocrine organs showed no definite abnormalities in the two cases coming to autopsy.

The authors conclude that the normal adult human pituitary gland is resistant to x-ray irradiation in doses up to 10,000 roentgens.

Eight illustrations; 1 table.

DONALD S. CHILDS, JR., M.D.
Rochester, Minn.

Malignancy in Adenoma of the Thyroid. Frank H. Lahey and Hugh F. Hare. J. A. M. A. **145**: 689–695, March 10, 1951.

Except for the rare cases of carcinoma in hyperplastic thyroid glands, it is now quite generally accepted that the origin of cancer of the thyroid is in a pre-existing adenoma. There is, however, much confusion as to the incidence of malignant change in adenoma of the thyroid. This is due, in part at least, to failure to differentiate between the true tumors of the thyroid, *i.e.*, the discrete adenomas, and the false tumors or multiple adenomatous goiters, which are due to degenerative processes in the gland. In a series of 1,971 consecutive discrete adenomas seen at the Lahey Clinic (Boston), the incidence of malignant change was 10.04 per cent, while of a series of 1,782 multiple adenomatous goiters, only 0.62 per cent became malignant.

Distinguishing features of the discrete adenoma are its tendency to occur as a single tumor (though two or three may be present), a definite capsule with a thick wall, and varying degrees of differentiation of the tissues within this wall. Differentiation between a benign and a malignant tumor cannot be made before operation.

All discrete adenomas of any size, and in patients of any age, should be removed, preferably intact and unruptured, with preservation of as much of the normal thyroid as possible until the pathologist's report is at hand. If this indicates the necessity of radical neck dissection, it may be carried out at once. Indications for the latter procedure are discussed and comment is made as to the extent of the dissection.

The authors include a review of 428 cases of thyroid cancer which they have classified clinically. On the basis of this series it is concluded that the five-year survival rate without recurrence is very definitely correlated with whether or not the malignant neoplasm is entirely within the capsule at the time of the removal of the discrete adenoma. It has further been made evident to us that the number of patients with discrete adenomas of the thyroid in whom the cancerous growth is entirely within the capsule of the adenoma decreases very definitely as the grade of malignancy increases.

In grade I tumors that have remained encapsulated, postoperative irradiation has not been considered necessary. In cases with evidence of extension beyond the capsule, or of histologic grade II, with or without extension, irradiation has been thought advisable. The following outline has been followed:

1. Radiation therapy is started postoperatively as soon as the condition of patient warrants, usually six days.
2. Treatment is planned to cover tumor bed and surrounding lymphatics.
3. It is planned to deliver a tumor dose of 4,800 r in twenty-eight treatment days.
4. A half-value layer of 2 mm. of copper, or better, is employed.
5. Moist skin reaction is avoided.

Radioactive iodine is useful for two purposes in treatment of thyroid cancer: (1) as a tracer to determine whether or not any tumor remains; (2) as a curative agent in cases of malignant thyroid tumors that take up iodine (I^{131}) in large enough quantities to destroy the tumor.

Total thyroidectomy is advisable before beginning radioactive iodine treatment of metastases, as this increases the uptake in the secondary lesions. Radioactive iodine has proved of value largely against tumors that contain colloid.

Four illustrations; 4 tables.

I. EARL HOLMES, M.D.
University of Louisville

Histological Changes in Irradiated Carcinoma of the Breast. I. G. Williams and G. J. Cunningham. Brit. J. Radiol. **24**: 123–133, March 1951.

Eighteen cases of breast cancer were investigated histologically before and after irradiation. In 14 cases the breast was irradiated through two tangential fields for a dose of 3,500 r in twenty-eight days and the lymph node areas through two parallel fields, to in-

clude the axilla and supraclavicular fossa, for a dose of 3,000 r to the skin in the same period. The half-value layer was 1.8 mm. Cu. Four cases were treated with the million-volt unit (h.v.l. 9.2 mm. Cu) for an estimated dose of 4,500 r throughout the breast and axillary region in forty days. The breasts were removed from one to eighteen months after irradiation.

Fourteen cases for which histologic preparations were available are described. Complete macroscopic and microscopic studies could not be made in all of these, however. The whole breast was studied in 8 and the lymph nodes in 5. In the remainder only sections were available.

Extensive destruction of the cancer was found in 7 cases, moderate in 4, and slight in 3. All cases showed production of elastic tissue. Many arteries showed endarteritis obliterans. Residual cancer tissue was found in all breasts except one. The residual cancer did not appear degenerated nor was it encysted.

From this study it is obvious that the assumption that irradiation renders residual cancer non-viable is not justified. Long delay in surgical removal of the breast after irradiation may encourage spread and metastasis.

Eleven photomicrographs.

SYDNEY J. HAWLEY, M.D.
Seattle, Wash.

Advances in the Treatment of Carcinoma of the Cervix. Michael J. Jordan. Wisconsin M. J. **50**: 261–267, March 1951.

A very complete and well balanced summary of the present position of irradiation and surgery in the treatment of cancer of the cervix is presented. At New York's Memorial Hospital Center, from which this report comes, the most effective irradiation method has been found to be multiple high-voltage x-ray therapy around the pelvis, through six to eight portals at 70 cm. target-skin distance with a daily dosage of 200 to 250 r (in air) to each of two fields, the total to each portal being 2,000 to 2,400 r. In addition, high-voltage vaginal cone therapy is used, with a 3.5-cm. diameter cone, 250 kv., 55 cm. target-skin distance, 750 r per treatment for a total dose of 3,750 r to each of three portals (central and right and left lateral). X-ray irradiation is followed by a single application of radium in the uterine canal for an approximate dosage of 3,000 to 3,500 mg. hours.

The author, who is himself a surgeon, has obtained his best results with a combined vaginal-abdominal operation. He is an ardent advocate of preoperative irradiation, preferably through a 3.5 to 4.0 cm. central vaginal cone, at 250 kv. and 55 cm. target-skin distance, for a total dosage of 3,750 r in six treatments over a period of two weeks.

Re-irradiation is rarely successful and should not be attempted when the patient fails to respond to the initial course, since the chance of a radical operative cure will be seriously jeopardized.

In the discussion of radical surgery it is emphasized that it should be left to those with experience, since the extent of the operation cannot be accurately foretold. Extraperitoneal lymphadenectomy is recommended with enthusiasm as a procedure to be done on any Stage I, II, or III case in which the primary tumor is controlled by irradiation and as an adjunct to radical vaginal operation. The high incidence of positive nodes found by the advocates of radical surgery (Meigs, etc.) is a valid reason for this operation.

Pelvic evisceration is discussed briefly as a palliative measure in uncontrolled advanced cases.

Serial biopsy is mentioned as a means of determining which cases are not likely to respond to irradiation. Another important aspect is the status of the urinary tract, since so many deaths are due to uremia (both controlled and uncontrolled cases).

This article should be read in the original, since it is in itself a summary. It deserves more widespread reading than it is likely to receive in a state journal.

One table.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Factors Influencing Prognosis in the Treatment of Carcinoma of the Cervix Uteri. William E. Costolow and James F. Nolan. Am. J. Obst. & Gynec. **61**: 548–556, March 1951.

A series of 588 cases of carcinoma of the cervix treated primarily with external roentgen irradiation and intracavitary radium application is analyzed with regard to factors affecting prognosis.

There was a significantly improved result with higher radiation doses in the advanced League of Nations classifications. Results in Stage I were at least as good with smaller doses. Exophytic tumors as compared to infiltrative and cratered types showed better results in the early stages of disease. The histologic type did not affect the outcome. The age of the patient was apparently not significant.

Comparison of the incidence of complications in relation to result showed no significant difference between the success and failure groups having irritative phenomena (cystitis, proctitis) or infections. A questionable increase was noted in the incidence of fistulas and inflammatory reactions in the failure group.

Eighteen graphs; 1 table.

MASON WHITMORE, M.D.
Jefferson Medical College

Endometrial Carcinoma. J. H. Randall, D. F. Mirick, and E. E. Wieben. Am. J. Obst. & Gynec. **61**: 596–602, March 1951.

The authors report on 330 patients with proved endometrial carcinoma admitted to the University of Iowa Hospital and followed for five years or longer.

Endometrial carcinoma was found in this series, as in others, to be chiefly a postmenopausal disease, uncommon (2.6 per cent of cases) in women under forty years of age. By far the most frequent symptom, in most cases the only one, was irregular vaginal bleeding.

The method of choice in treatment, in the hands of this group, is intrauterine application of radium in multiple capsules followed in four to six weeks by a simple total hysterectomy. From five to ten radium capsules are used, each containing 10 mg. of radium filtered by 1.0 mm. of platinum and encased in rubber. The average number of milligram-hours given varies between 4,900 and 6,400. With this method of treatment in suitable cases, a five-year survival rate of 81.6 per cent was achieved. The over-all five-year survival rate for the entire 330 cases treated (by various methods) was 56.2 per cent.

The authors present a number of tables analyzing the five-year survival rate in their series in relation to age, previous pregnancies, symptoms, stage of the carcinoma, histologic grade, associated disease, and type of therapy.

T. FREDERICK WEILAND, M.D.
Jefferson Medical College

Diagnosis and Treatment of Testis Tumors. Archie L. Dean. New York State J. Med. **51**: 485–492, Feb. 15, 1951.

Enlargement and hardness of the testis are the usual symptoms of carcinoma of that organ, but at times the first complaint is backache caused by secondary involvement of the para-aortic lymph nodes. If a tumor is suspected, the first step is to look for metastases (lungs, mediastinum, abdomen). If none are found, or if they are present only along the para-aortic nodes, the next step is a careful orchiectomy on the involved side, with removal of the spermatic cord up to the abdominal ring.

After the type of tumor is determined, irradiation of the lymph pathways is done up to the renal pedicle. The mediastinum and supraclavicular areas may be treated, but if metastases are present in these areas, there will probably be others in the liver, lungs, or other sites where a lethal dose cannot be delivered.

Seminomas are the most radiosensitive of the testicular tumors, requiring a tumor dose of only 1,500 r, but since so many of the tumors are composed of several cell types, the plan of treatment calls for a tumor dose of 3,000 r. The embryonal carcinomas and teratocarcinomas require a tumor dose of 5,000 r or even 6,000 r if possible. These cases must be watched for late complications from irradiation (myelitis, gastrointestinal perforation or stricture formation, bone marrow depression, etc.).

Following irradiation, some surgeons do a radical dissection of the para-aortic nodes as far as the renal pedicle in an attempt to improve the results.

End results in 364 cases treated at Memorial Hospital are:

	Well 5 Years or More
Embryonal carcinoma with lymphoid stroma and seminoma	54%
Embryonal adenocarcinoma	22%
Teratoma complex	33%
Choriocarcinoma	0%
Rare or unclassified	30%

Two photographs; three tables

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Extramedullary Plasmocytoma. Report of a Case. Henry M. Lewis, Egbert J. Henschel, and Gerald M. Frumess. Arch. Dermat. & Syph. **63**: 474–477, April 1951.

Although plasma-cell tumors of the bone marrow are seen frequently and recognized as a histologic counterpart of multiple myeloma, extramedullary plasma-cell tumors are presumed to be relatively rare. A case is reported in a 59-year-old male, who was referred for diagnosis and treatment of an asymptomatic lesion of the left nostril of three months duration. A firm, cylindrical, flesh-colored tumor, measuring about 5 mm. in length, was found attached to the mucosal surface of the left ala 2 mm. from the naris. The surface of the lesion was slightly verrucous and the walls were smooth. The tumor was excised *in toto* and the base lightly electrodesiccated. The histologic diagnosis was extraskeletal plasmocytoma. Roentgen radiation (no added filtration, 120 kv., 15 cm. target-skin distance) was administered, 600 r on alternate days, to an area surrounding the base of the original lesion, for a total of 4,800 r. There had been no recurrence of the tumor at the time of the report.

One photomicrograph.

Titrated, Regularly Spaced Radioactive Phosphorus or Spray Roentgen Therapy of Leukemias. Edwin E. Osgood. Arch. Int. Med. **87**: 329–348, March 1951.

Marrow culture studies have shown that the effect of small doses of ionizing radiation on either normal or leukemic cells is to decrease the rate of cell division. To accomplish this effect, the rays must reach the cell; no indirect action can be expected. Any action on leukemic cells which might be thought to be selective appeared rather to be due to their shorter life span and shorter intermitotic interval as compared with corresponding normal cells. One should utilize radiation therapy, therefore, in small doses to inhibit cell division rather than attempt to destroy leukemic cells with massive doses.

In the treatment of patients with leukemia by irradiation, the initial dose should not exceed 10 r of roentgen radiation or 20 microcuries of P^{32} per kilogram of body weight in lymphocytic leukemias, or twice these values in granulocytic leukemias. The second dose should not be given earlier than one week after the first, since a shorter time does not permit adequate evaluation of the effects of the original dose. The amount may be increased if the patient does not respond favorably, but no dose should be more than double the preceding one. The interval should not be increased by more than one week at a time if it is less than four weeks, or by over two weeks if it exceeds four weeks.

Since P^{32} has a biologic half-life of eight days, dosage effects are cumulative if the interval between treatments is much less than six weeks. The retained dose in terms of equivalent P^{32} level can be approximated by adding one-half the previous dose at one week, one-fourth the previous dose at two weeks, one-eighth the previous dose at four weeks, and so on.

Thirty-two of the 58 patients treated by irradiation were living at the time of this report. Twenty of the patients had chronic leukemic granulocytic leukemia and 38 had chronic leukemic lymphocytic leukemia. The mean duration of life from onset of the disease was 3.6 years for the total series, 4.0 years for those with granulocytic leukemia, and 3.4 years for those with lymphocytic leukemia. Over 80 per cent of the total 208 years of leukemic life in this series of patients has been spent in essentially normal living.

Six charts; 13 tables.

HOWARD L. STEINBACH, M.D.
University of California

Hemangiomas: Classification, Diagnosis and Treatment. George T. Pack and Theodore R. Miller. Angiology **1**: 405–426, October 1950.

The authors present their classification of blood-vessel tumors, with a discussion of the various types. Included is a section on radiation therapy.

Hemangiomas are more sensitive to irradiation during infancy and early childhood than in later years, but so are the normal tissues, especially bone. The immediate good result is sometimes spoiled by atrophy of the skin and subcutaneous tissues ten to fifteen years later. Radiation telangiectasia developing in the facial skin of children or young adults treated in infancy may require

surgical excision and plastic repair. The skin overlying the middle of the trunk, *i.e.*, the sternum and vertebral column, has a poor blood supply and radiotherapy occasionally results in a late necrosis. X-ray or radium treament for hemangiomas of the scalp is too often followed by permanent alopecia. The administration of x-rays or radium, even in seemingly small doses, may interfere with epiphyseal bone growth and shortening of limbs and facial asymmetries have occurred. The authors warn against the use of irradiation in the treatment of hemangiomas near the breast of female infants or external genitals of either boys or girls. They advise examination by an ophthalmologist before treating hemangiomas near the eye, orbit, or eyelid, to determine whether any defects related to the tumor are present. Radiation cataracts and glaucoma secondary to radiation iridocyclitis have been reported many times.

The deeply situated angiomatous mass can be interstitially irradiated by the intratumoral deposition of gold radon seeds (4 mm. long, filter, 0.3 mm. Au, radon 1-1.5 mc.) introduced with special hollow trocar needles The needles are inserted through the normal adjacent skin and thence deeply into the tumor, rather than directly into the tumor, in order to avoid unnecessary hemorrhage. Interstitial irradiation of cavernous hemangiomas of the tongue has been successful where no other treatment is possible save partial or total glossectomy.

In the average case, surface applications of radium seldom exceed one to two skin erythema doses; the dose may require repetition within four to ten months. The skin surrounding the hemangioma is protected by a lead shield perforated to expose the tumor. Whenever radium plaques are used at the conventional 1-centimeter radium-skin distance, the dose varies from 25 to 50 milligram or millicurie hours. Contact x-ray therapy may be substituted.

An unfiltered radon bulb (glass sphere, 4 mm. in diameter) containing 200 to 600 millicuries and emitting predominantly beta rays is a most useful contact applicator for tiny punctate hemangiomas.

Inoperable primary hemangiomas of bone, especially those in the vertebral column, are well treated by high-voltage x-rays, and the response to such therapy is most gratifying, providing no symptoms of spinal cord pressure exist. Hemangiomas of the liver exhibit a certain degree of radiosensitivity, and the enormous cavernomas of the liver can be obliterated by high-voltage therapy.

Hodgkin's Disease and Pregnancy. Review of the Literature and Report of a Case. William Teneblatt and Charles Horton. West. J. Surg. **59**: 120–121, March 1951.

The rare combination of Hodgkin's disease and pregnancy is considered on the basis of 32 previously reported cases and an additional case presented by the authors. Analysis of this material reveals that the effect of Hodgkin's disease on pregnancy is negligible and that pregnancy produces no effect on Hodgkin's disease, the patients having a similar clinical course whether pregnant or not.

Therapeutic interruption of pregnancy is not recommended. Radiation therapy can be given during pregnancy if necessary, with proper shielding of the fetus.

RICHARD A. ELMER, M.D.
Emory University

Juvenile Nasopharyngeal Angiofibroma. R. W. Kerwin. Arch. Otolaryng. **53**: 397–405, April 1951.

Juvenile nasopharyngeal angiofibroma is a relatively rare tumor, restricted apparently to adolescent males. It regresses as the patient reaches maturity (twenty to twenty-five years). Epistaxis is the chief symptom and usually is serious. Ligation of the carotid is of questionable value. Surgical extirpation is almost impossible. Recurrences are common, and the secondary growth is rapid and large. Irradiation and hormone therapy are believed to offer the best chance of control.

The latter measures were used in the case reported here, in a 16-year-old boy. The tumor was about 5 cm. in diameter, soft and easily reducible so that removal by grattage was impossible. Following biopsy, 16 x-ray treatments were directed to the nasopharynx, 8 to each side (200 kv., 25 ma., 1.0 mm. Cu and 1.0 mm. Al filtration, fields 10 × 15 cm., focal skin distance 50 cm., 250 r at surface of field in 6.5 minutes). Coincidentally androgen in the form of testosterone propionate was given. At the time of the report, about a year later, the mass had shrunk until it was as small as it had ever been, *i.e.*, approximately 1.5 to 2.0 cm. The patient was then doing heavy work; he had recently had two or three upper respiratory tract infections with no recurrence of bleeding.

Small Dose X-Ray Therapy in Non-Specific Inflammatory Diseases of the Lung. Rüdiger Seyss. Radiol. clin. **20**: 111–119, March 1951. (In German)

The author treated with x-rays 72 cases of inflammatory lesions of the lungs, most of which had been resistant to sulfa drugs and penicillin. These included 8 cases of pneumonia of less than two weeks duration (Group I), 53 of longer duration (Group II), and 11 cases classed separately (Group III).

The age of the patients in Group II varied from two and a half to eighty-four years. The average duration of the lung disease prior to onset of radiation therapy was thirty-seven days. In this group 22 patients recovered completely—clinically as well as radiographically—after radiotherapy. Twenty-three cases showed residual pulmonary densities (*i.e.*, "scars"—G. S. S.), hilus enlargement or minimal pleural adhesions, but were clinically cured. Eight patients revealed larger scars, which were also demonstrable clinically. These results were achieved within twenty-one days (average of all cases in this group).

The majority of the cases in Group II received six treatments of 5 r each, three treatments per week. The field was a large one and included the entire thorax and the head. The factors were: 180 kv., 0.5 mm. Cu plus 1.0 mm. Al, target-skin distance 80 cm.

The acute cases of Group I received daily treatments. The author feels that no great weight can be attached to the observations on this small group.

There was no good correlation between the bacteriologic findings and the response to x-ray treatments. The author suspects that the effect is a non-specific one. He refers to earlier experiments, which have shown changes of the blood picture, of the potassium-calcium ratio, the blood-sugar level, and of the electrocardiogram following small-dose irradiation of the diencephalon. He concludes that the effect is probably an anti-allergic one. He considers these x-ray treatments of value in the therapy of otherwise resistant pneumonias.

GERHART S. SCHWARZ, M.D.
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Interstitial Radium Therapy. Description of a Short Intensive Technic. C. F. Lehmann and J. L. Pipkin. Arch. Dermat. & Syph. **63**: 312–321, March 1951.

The authors describe a short intensive method for interstitial radium therapy for superficial carcinoma of the skin. The needles used contain 10 mg. of radium element in the form of the sulfate, are 19 mm. long, 1.3 mm. in diameter, and have a wall thickness of 0.3 mm. of platinum. The radiation passing through that filter is composed of 9 per cent beta rays and 91 per cent gamma rays. The needles are placed interstitially, usually in a single plane at the base of the lesion. They are arranged in the following ways: (1) in a triangle, about the borders of small lesions; (2) in parallel rows, unless the central two-thirds of the needle does not approximate 3 mm. distance from the border of the desired field of radiation, in which instance another insertion is made at the right angle in the border of the lesion; (3) in a rectangle or hexagon (rarely). If, in this last arrangement, there are more than four needles, they are placed in the center of the lesion 5 mm. apart.

The distribution of the needles varies with the intensity desired. For a very intensive dose, they are placed as close as 3 mm. (between needle walls). Where a radiosensitive tumor is being treated, the distance between the needles may be as much as 5 mm. The aim is to get as selective an effect as possible, to prevent radiation scarring. The optimum time for such insertions is two and a half hours. The anesthetic used is procaine hydrochloride 2 per cent.

From January 1931 to August 1945, 5,490 lesions were treated with the short intensive technic, while 123 lesions were treated by the long low-intensity method. Most of the lesions treated by the short intensive method were basal-cell carcinomas. The method is particularly suitable for basal carcinoma in the concha of the auricle or in the auditory canal (when the growth is discovered early, a cure may be expected without the painful reactions in the ear drums which accompany the use of heavy, more penetrating qualities of radiation) and for basal-cell carcinoma at the auriculomastoid junction. Very large lesions are usually treated by other means, totally or adjunctively. The majority of the lesions on the face treated by the short method did not measure over 1.5 cm. in their longest diameter.

The cosmetic result following the short method is comparable to that following interstitial radium therapy with the use of 0.5 mm. platinum filtration. The scars from the short treatment hold up as well as those from any other treatment, and with moderate after-care the patients do very well. In some rare instances post-irradiation ulcers developed; in these cases it is thought that the limits of the technic were exceeded: (1) either the needles were spaced too close together, (2) they were left in place too long, or (3) a recurrence was retreated after previous surgical excision or irradiation, either of which leaves a deficient vascular supply to the cancer bed.

The saving of time for the patient with the short intensive method of radium therapy is a distinct advantage. The cost of hospital care and the time lost from work for hospital procedures are also important considerations. The short method also permits distribution of radium to patients with maximum efficiency.

Patients receiving the treatment are given instructions regarding the reaction (an epithelitis that results in an eroded, exudative area the length of the needle), which appears in about two weeks, is at its height for about ten days, and then rapidly disappears. The skin erythema gradually fades in from one to two months. The application of ammoniated mercury ointment, 5 per cent, is advised during the reaction. In about the third week of the reaction a thin necrotic membrane covers the lesion. Frequently, when the patient is available, this is curetted away and Monsell's solution, which dries the area, is applied (the solution is not applied to the lip or eyelid). Ordinarily the patient is not seen after the treatment for five or six weeks, then twice more at two-month intervals, and then yearly.

Precautions against over-exposure of the physician and personnel to radiation are emphasized.

Twenty-four photographs.

Low Voltage X-Ray Therapy with a Beryllium Window Tube. Part I: Introduction and Advantages. Anthony Green. **Part II: Achievement of Optimum Depth Dosage Distributions—from the Physical Standpoint.** W. A. Jennings. **Part III: Technique Reactions and Results.** R. F. Hendtlass. Brit. J. Radiol. **24**: 134–147, March 1951.

Green points out that the advantages of the beryllium window tube are that it offers a wide range of depth penetration for superficial lesions and a high dose rate. The high dose rate permits longer distances and consequently larger areas, or for short distances very short treatment times. The low penetration is valuable in certain areas such as the eyelids and scrotum. A low integral dose is a further advantage.

Jennings reviews the methods of measurement of surface and depth doses. He presents the various relationships between voltage, current, area, and filtration by means of graphs.

Hendtlass points out that the character of the lesion determines the technic to be used. As to reactions, three waves of erythema may be recognized after irradiation. With voltages above 80 kv.p. only the second is important, as the third is rarely seen. With lower voltages the third wave is the important one. After large doses, 6,000 to 10,000 r in one week, a moist desquamation develops between the thirtieth and sixtieth day. It eventually heals, though with the higher doses many weeks may be required.

Rodent ulcers, warts, tonsillar hypertrophy, and senile keratoses have been successfully treated.

Sixteen illustrations. SYDNEY J. HAWLEY, M.D.
Seattle, Wash.

Some General and Neurologic Aspects of Atomic Medicine. David I. Arbuse. J. Nerv. & Ment. Dis. **113**: 189–197, March 1951.

In a very general but readable and understandable manner, the author discusses some of the methods and applications of radioactive isotopes to medicine. Particular emphasis is placed upon the uses of certain radioactive isotopes in relation to neurology. The use of phosphorus^{32} and iodine^{131}-labeled diiodofluorescein in the diagnosis and localization of brain tumors is described, and the use of radioactive iodine in the diagnostic differentiation of hyperthyroidism from severe types of psychoneuroses and other conditions exhibiting hypermetabolism is also discussed.

The material presented should be of value to the neurologist not familiar with the problems of atomic medicine, who wishes to obtain a limited general background.

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RADIOISOTOPES

Uptake of Radioactive Iodine After Intravenous Administration of Tracer Doses. Joseph P. Kriss. J. Clin. Endocrinol. **11**: 289–297, March 1951.

While the uptake of radioiodine by the thyroid gland is abnormally high in most cases of untreated hyperthyroidism after oral administration of the tracer, a significant overlap exists between the normal range of uptake and the range in hyperthyroidism. It is in these borderline cases that the clinician has the most difficulty in establishing the correct diagnosis. The author hoped, by administering the tracer intravenously and eliminating the variables of rate and amount of gastro-intestinal absorption, to reduce the area of overlap.

Carrier-free radioactive iodine, I^{131}, was prepared for intravenous use by dilution with sterile physiologic saline in sterilized, rubber-capped bottles. The bottles were then placed in a boiling water bath for ten minutes with a 25-gauge needle through the stopper for an air vent, after which their contents were standardized against a standard solution of radioiodine. The dilution was such that some 5 or 10 c.c. carried the desired test dose of 40 to 100 microcuries. This was given rapidly by vein. Readings with a shielded Geiger counter 10 cm. from the thyroid region were begun immediately and repeated every ten or fifteen minutes for an hour, and again at twenty-four hours. Immediately after each reading over the neck, a reading was taken at the same distance at mid-thigh level and applied as a background correction by subtraction from the neck reading. By comparing the net count with the radioactivity of a standard solution, the quantity of I^{131} in the thyroid was calculated and recorded in terms of per cent of the administered dose.

The experimental subjects included a control group of 6 males and 13 females without evidence of thyroid disease; 1 male and 17 females with clinically unmistakable hyperthyroidism; 8 females with a clinical diagnosis of non-toxic goiter; 3 females with a clinical diagnosis of probable hyperthyroidism; 1 female with classical myxedema and a basal metabolic rate of −36 per cent.

The uptake value one hour after administration of the tracer was found to differentiate satisfactorily between the euthyroid and hyperthyroid state, and to exhibit excellent correlation with the degree of clinical toxicity. The method was also found to offer advantages over the 24-hour oral method in rapidity and in diagnostic accuracy, by reducing the overlap in values between normal and hyperthyroid subjects.

Five charts.

Treatment of Tumors of the Thyroid with Divided Doses of Radioactive Iodine. George Crile, Jr. Am. J. Roentgenol. **65**: 415–419, March 1951.

The treatment of 30 patients with nodular goiter and hyperthyroidism with I^{131} brought about a reduction of one-third to two-thirds in size of the goiter after control of the hyperthyroidism, but in no case did the goiter disappear completely. This type of goiter is best treated with divided doses of I^{131} because of the irregular distribution of tracer doses as indicated by radioautographs, almost all of the I^{131} being taken up by the few small active areas.

Uptake of I^{131} by papillary carcinoma of the thyroid is just as irregular as that of multinodular goiter. Carcinomas of this type, therefore, as of any type in which the uptake is of this irregular nature, cannot be expected to regress after a large single dose. Nine patients with papillary carcinoma were given tracer doses of I^{131} before operation and postoperative radioautographs showed that only 2 of the 9 took up significant amounts of the isotope. Most of the other malignant tumors of the thyroid, except for angio-invasive adenomas, do not take up I^{131}. Fortunately most papillary carcinomas are operable.

One case is reported in which slow but steady regression of papillary carcinoma of the thyroid followed repeated doses of I^{131}. At first the tumor was considered inoperable, but later a partial resection was done and I^{131} was given postoperatively. The patient received 335 mc. in eight doses over an eighteen-month period. He was then given an additional 80 mc., bringing the total dosage to 415 mc. Seven years after the thyroid carcinoma was first noted no tumor was palpable in the neck.

If normal thyroid function is abolished by thyroidectomy or administration of I^{131}, the pituitary is stimulated to increase its output of thyrotropic hormone. This may stimulate the thyroid tumor to take up I^{131} and result in its destruction. If the tumor does not take up I^{131}, the thyrotropic stimulation may cause it to grow more rapidly and hence may shorten the course of the disease. The case of a patient who became worse and died nine months after initiation of treatment with I^{131} is presented to illustrate this adverse effect.

One radioautograph; 1 photomicrograph.

WILLIAM H. SMITH, M.D.
University of Louisville

Osseous Metastases of Adenocarcinoma of the Thyroid. Leonard Barnard. West. J. Surg. **59**: 123–126, March 1951.

The author reports a case of carcinoma of the thyroid with metastatic involvement of two ribs and the pelvis on both sides of the right sacroiliac joint. The treatment plan consisted of uptake studies with I^{131} followed in turn by thyroidectomy, repeat uptake determinations, and finally therapeutic doses of I^{131}. Following treatment there was clinical evidence of improvement in the first year, though radiographs failed to show any significant change in the destructive lesion of the right hemipelvis. In the second year a pathological fracture occurred through the pelvis and deep x-ray therapy was given. A biopsy in this area failed to disclose any active tumor but showed substitution with dense fibrous tissue. The patient, at the time of the report, was ambulatory, without pain, and in generally excellent health.

Four roentgenograms. RICHARD A. ELMER, M.D.
Emory University

Uptake of Labelled Phosphorus by Cancer of the Cervix: Preliminary Report. Somers H. Sturgis, Edgard DeMuylder, and Joe V. Meigs. Ann. Surg. **133**: 305–312, March 1951.

This study attempts to determine whether injections of P^{32} might be of value in some problems related to carcinoma of the cervix. The isotope was injected intravenously, and some forty-eight hours later a

biopsy of the cervix was done and a sample of venous blood was obtained. Where possible, a piece of normal cervix was also removed. There were 28 patients in the series, including 9 awaiting hysterectomy for nonmalignant disease, 4 with carcinoma *in situ*, and 15 with invasive cervical cancer. Samples of tissue (25–50 mg.) were minced, weighed wet, allowed to dry overnight, assayed for P^{32} and corrected for background and for decay to I_0, the time of injection. (This allowed comparison with blood and serum samples, similarly corrected.) Microscopic sections were made of tissue contiguous with that assayed for P^{32}.

Absolute counts and comparison between patients are not accurate because of the many factors that play a part, and in few patients with carcinoma was it possible to obtain also normal cervical tissue. Comparison of uptake of P^{32} by carcinoma tissue and by serum was made. This is the principle utilized by Silverstone, who compared the uptake by brain tumor tissue with normal brain tissue *in the same patient*. The dose per kilogram and other factors can thus be disregarded. The *ratio* of uptake of P^{32} between a given tissue and serum in the same case was thus used as the basis of comparison.

Invasive malignant tissue showed a significantly higher ratio of uptake than did cervices with chronic infection or squamous metaplasia. This was also true in comparison with other pelvic tissue. Pick-up of P^{32} by carcinoma *in situ* was somewhat elevated, but less so than of invasive carcinoma tissue.

It is concluded that the high values for P^{32} in cervical carcinoma tissue after forty-eight hours represent an increase in total phosphorus over that found in normal controls. Further investigation by biochemical analysis to confirm this and to compare the turnover rate for phosphorus in benign and malignant cervical tissue has been started.

Six photomicrographs; 4 graphs; 2 tables.

GEORGE R. KRAUSE, M.D.
Cleveland, Ohio

Iron Metabolism in Human Pregnancy as Studied with the Radioactive Isotope, Fe^{59}. P. F. Hahn, E. L. Carothers, W. J. Darby, M. Martin, C. W. Sheppard, R. O. Cannon, A. S. Beam, P. M. Densen, J. C. Peterson, and G. S. McClellan. Am. J. Obst. & Gynec. **61**: 477–486, March 1951.

In an earlier study (Balfour, Hahn, *et al.*: J. Exper. Med. **76**: 15, 1942) it was found that a pregnant woman absorbed two to ten times the amount of tagged iron usually taken up by a non-pregnant person. The present study is based on a much larger series, 466 pregnant women in whom it was possible to complete the study. The radioactive iron was obtained by d,p bombardment of iron in the cyclotron, and therefore was essentially the Fe^{59} isotope.

An unselected group of white women admitted to the Obstetric Out-Patient Clinic of Vanderbilt University Hospital were fed single doses of iron tagged with the radioactive isotope, Fe^{59}, on their second prenatal clinic visit prior to any administration of therapeutic iron. On the third visit, usually two weeks following administration of the tagged iron, duplicate blood samples were drawn for measurement. The radioactivity per milliliter of red blood cells was calculated. The total circulating red cell mass was estimated, and from this the total circulating radioactive iron was calculated.

It was found that iron uptake was related to dosage level and to period of gestation. At a given dosage level the uptake increased as gestation progressed from the 10th or the 15th week up to the 30th or 35th week. (Few patients were seen before the 10th week or after the 35th week.) The percentage uptake was greatest at dosage levels of 9 mg. or less. With an 18-mg. dose the percentage uptake was lower and subsequent increases in dosage to 39 and 120 mg. were accompanied by decreases in the percentage absorbed.

It was known that some of the iron crosses the placenta and is transmitted to the fetus (Pommerenke, Hahn, *et al.*: Am. J. Physiol. **137**: 164, 1942). Accordingly in 68 cases blood was taken, at the time of delivery, from the fetal umbilical cord and from the mother, and the amount of radioactive iron per milliliter of red cells was determined for each sample. On this basis, the ratio of the estimated total percentage of the uptake of iron by the infant's blood to the uptake by the mother's was computed. Median ratios of 0.07 to 0.1 were obtained, regardless of time of administration of the iron in relation to gestation, or the dosage level. The radioactive iron in the blood of the infant, therefore, was 7 to 10 per cent of that absorbed by the mother and incorporated in her red cells.

Three charts; 4 tables.

J. KOHL, M.D.
Jefferson Medical College

Preliminary Depth Dose and Isodose Measurements for Cobalt-60 Teletherapy Unit. W. R. Dixon, F. Fish, and A. Morrison. J. Canad. A. Radiologists **2**: 12–13, March 1951.

Depth dose and isodose distribution measurements in a masonite phantom were made with a $cobalt^{60}$ source giving about 0.7 r per minute at a distance of a meter. Collimation of the beam was produced by lead diaphragms. Measurements were made both with small integrating ionization chambers of 1.2 cm. length and 1.0 cm. outside diameter, and with DuPont 506 radiographic film.

Measurements were made for a source-to-phantom distance of 125 cm. and for fields of 6 × 6 cm. and 11 × 13 cm. The maximum depth dose occurs from 3 to 5 mm. inside the phantom. At a depth of 10 cm. the depth dose for the 11 × 13-cm. field is about 56 per cent. The 50 per cent depth dose occurs at 12.6 cm. for the large field and at 11.6 cm. for the small field.

[See also Editorial on $Cobalt^{60}$ as a Source for Radiotherapy. Radiology **58**: 113, January 1952.—ED.]

Two isodose curves.

DEAN W. GEHEBER, M.D.
Baton Rouge, La.

Determination of the Sodium^{24} "Space" in Infants, Children, and Adults. Anne Perley, Gilbert B. Forbes, and Miriam M. Pennoyer. J. Pediat. **38**: 299–305, March 1951.

The authors report estimations of the fluid through which Na^{24} is rapidly distributed (sodium "space") based on observations on 19 adult males, 37 full-term infants and children, and 11 premature infants. The measurements were made from an hour and three-quarters to four and a half hours after intravenous injection of the Na^{24}.

In the 11 premature infants the sodium "space" averaged 43.5 per cent of body weight, and in 16 full-term newborn infants 35.2 per cent. In 7 children from one to fourteen years of age, the values averaged 30.2 per cent, and in 19 adult males 25.2 per cent.

Although the sodium "space" computed as per cent of body weight varied considerably in given weight

ranges, the data indicate that the volume of fluid occupied by sodium in relation to body weight declines as growth proceeds.

Three charts.

Theory and Methods of the Radioautographic Localization of Radioelements in Tissues. J. Gross, R. Bogoroch, N. J. Nadler, and C. P. Leblond. Am. J. Roentgenol. **65**: 420–458, March 1951.

This paper is a most comprehensive discussion of all phases of radioautography. The three major methods of radioautographic preparation are: the contact, the coating, and the mounting methods. The contact method requires no special equipment and can be routinely used in any clinical laboratory. The section is placed close to the photographic film or plate and gives relatively poor resolution due to rather significant interspace between emulsion and specimen. This is avoided in the other methods. In the coating method, a fluid photographic emulsion is poured over the stained specimen. The last method consists of floating the paraffin sections of tissues onto a photographic plate and staining after development and fixation. By the two latter methods images less than 10 micra apart can be resolved and intracellular localization in favorable cases is possible.

Technical considerations as to selection of emulsion and exposure factors are discussed. From the clinical aspect the uses of all currently available radioelements are mentioned and illustrated by multiple photographs.

The paper is recommended in its original form for those interested in this subject.

Multiple diagrams, photographs, and drawings accompany the article.

I. R. BERGER, M.D.
University of Louisville

Biologic Effects of Radioactive Phosphorus Poisoning in Rats. Simon Koletsky and James H. Christie. Am. J. Path. **27**: 175–209, March–April 1951.

This report summarizes a study of the biologic and morphologic effects of radioactive phosphorus poisoning in rats. Interest centered on the types of lesions produced by this form of internal radiation, their progressive development, variation in distribution and severity, effects on the organism as a whole, reversibility or irreversibility, and the factors involved in causing death. The doses of P^{32} employed in the study were in the lethal range.

It was found that lethal doses of radioactive phosphorus produced extensive morphologic lesions. These were similar to previously described effects of radiation from either external or internal source, in both animals and man. Similar changes result also from the nitrogen mustards. By virtue of its distribution, P^{32} acted as a powerful hemopoietic poison, producing aplasia of the bone marrow and hypoplasia of the lymphoid tissues of the body, including spleen and thymus. This was reflected in the peripheral blood by rapidly developing leukopenia, thrombocytopenia, and anemia. In addition, the intestinal tract, especially the small bowel, and the gonads were sensitive to radiation. Organs such as the liver, pancreas, adrenals, kidney, heart, and brain were radioresistant.

Destruction of tissue occurred rapidly, being well developed from six to twelve hours after injection of the isotope. The principal mode of cell destruction was by karyorrhexis. Most of the resulting débris was removed by the second or third day. Involution of the hemopoietic organs was marked at the end of twenty-four hours and was then progressive over the next few to several days.

During the period of necrosis and involution the animals usually were in good condition and asymptomatic. This latent interval, however, was followed by progressive inanition, debility, and weight loss, terminating in death within three weeks after administration of the radioactive material. At the time of death there were aplasia of bone marrow, atrophy of lymphoid tissues, and persistent leukopenia, but the hemopoietic system often revealed beginning or even fairly substantial regeneration; the intestinal damage was largely repaired, while the injury to testes was progressive.

In animals which recovered there was usually good repair of bone marrow and lymph nodes after a few months. Regeneration was less effective in spleen and thymus, and in the testis generally ranged from slight to negligible.

One of the late effects of P^{32} poisoning was the development of malignant neoplasms.

The mechanism of radiation death is not established. With massive doses of P^{32}, after which death takes place within a few days, the outcome is usually attributed to a general toxemia resulting from extensive destruction of tissue. With LD 50 doses of P^{32}, after which death occurs within a few weeks, the almost constant presence of infectious lesions suggests that bacterial toxemia may be significant.

Thirty-seven photomicrographs; 13 radioautograms.

An Attempt to Measure Renal Circulation Time With P^{32}. H. D. Bruner, John K. Clark, and Harold G. Barker. Am. J. Physiol. **164**: 618–623, March 1, 1951.

Trueta *et al.* (Studies of the Renal Circulation, 1947) have proposed that intrarenal diversion of blood through juxtamedullary vascular shunts may be of importance in the pathogenesis of many renal functional disorders as well as essential hypertension. The authors therefore attempted to develop quantitative experimental physiologic technics whereby such changes might be detected and evaluated. The method in general consisted of simultaneously measuring systemic arterial blood pressure, renal blood flow, and renal circulation time, the latter by means of the radioisotope P^{32} in order to obtain a continuous objective measurement.

In anesthetized, eviscerated dogs and rabbits no consistent relationships were found among renal circulation times as measured simultaneously by Evans blue dye and by P^{32}, arterial blood pressure, renal blood flow, and renal vascular resistance. The return of P^{32} from the kidney following intra-arterial injection occurred as a protracted wave extending over a considerable time. This was true of the cephalic, coronary, splenic, and femoral circulations as well.

The P^{32} circulation time method provided an objective measure of the shortest vascular route but, in common with the dye method, gave no information bearing on any identifiable physiologic factor. Injections of P^{32} into individual glomerular capsular spaces in amphibia indicated that some of the protracted return from the kidney may be due to a detour of the P^{32} into the glomerular filtrate with subsequent tubular reabsorption.

Five figures.

Use of Radiophosphorus in Studies of Glomerular Permeability of Plasma Inorganic Phosphate. Philip Handler and David V. Cohn. Am. J. Physiol. **164**: 646–653, March 1, 1951.

When single tracer doses of P^{32}, with or without carrier, were intravenously injected into dogs, the specific activity of the urinary inorganic phosphate was found to be as much as 32 per cent above that of the specific activity of the corresponding plasma inorganic phosphate. This difference usually disappeared within twenty-five minutes. When the specific activity of the plasma inorganic phosphate was caused to rise, fall, or remain constant, the differences in specific activity between urine and plasma inorganic phosphate were markedly altered or entirely abolished. When a small amount of radioactive plasma from an apparently equilibrated dog was given to a second dog, differences in specific activity of urine and plasma inorganic phosphate were of the same order of magnitude as in animals receiving untreated P^{32}. It is concluded that the greatest part of these differences may be explained on the basis of a lag between the time inorganic phosphate is filtered by the glomerulus and the time at which it reaches the bladder for collection. The evidence suggests that the greater part of the inorganic phosphate of plasma exists in a simple, filterable state.

Five figures.

Effect of a Carcinogenic Azo Dye on Radiophosphorus Turnover in Rat-Liver Nuclei and Cytoplasm. A. Clark Griffin, Lew Cunningham, Eugenia L. Brandt, and D. W. Kupke. Cancer **4**: 410–415, March 1951.

Normal rats, rats receiving a carcinogenic azo dye, and rats having liver tumors induced by this dye were injected intraperitoneally with radioactive phosphorus. The animals were subsequently sacrificed and the liver and tissues were divided into fractions representing acid-soluble, lipid-soluble, desoxyribonucleic acid, and ribonucleic acid components. Nuclei were also prepared from the tissues and fractionated similarly. Total phosphorus, P^{32}, and nucleic acid determinations were made on various fractions.

Normal liver, liver undergoing precancerous change, and liver tumors were found to have different patterns of phosphorus metabolism. In normal liver the predominant process is a rapid turnover of phosphorus in the cytoplasm. This type of metabolism is presumably associated with the general high level of metabolic activity of this organ. Tumor cells, on the other hand, incorporate radiophosphorus into nuclear structures. During carcinogenesis as exhibited by the liver-phosphorus metabolism pattern in rats given a carcinogenic agent, a transition toward the established tumor pattern was shown.

The most obvious differences between the three tissues examined were in the rate of incorporation of P^{32} in desoxyribonucleic acid. The degree of incorporation of the isotope in this fraction could be correlated roughly with the degree of mitotic activity.

One graph; 2 tables.

DONALD S. CHILDS, JR., M.D.
Rochester, Minn.

Tissue Localization and Excretion Routes of Radioactive Diethylstilbestrol. Gray H. Twombly and Erwin F. Schoenewaldt. Cancer **4**: 296–302, March 1951.

It has been shown that diethylstilbestrol, when given in large doses over long periods of time, is capable of producing malignant tumors in experimental animals. It is also well know that this estrogen has truly remarkable effects in temporarily controlling certain forms of human cancer.

This article describes the preparation of radioactive diethylstilbestrol and its distribution and excretion in mice following subcutaneous administration. In addition, it was injected into one rabbit and one dog. The injected material showed no selective absorption in the uterus, pituitary, or breast. The highest concentration in any solid organ was in the liver. The radioactive material was absorbed quickly, and most of it was excreted in twenty-one hours. The principal excretion was through the bile into the feces; 70 to 85 per cent was so eliminated, and 15 to 30 per cent appeared in the urine.

Four tables.

DONALD S. CHILDS, JR., M.D.
Rochester, Minn.

Tumor-Host Studies. III. Alteration of Thyroid, Skin, Blood, and Tumor Uptake of I^{131}-Tagged Diiodotyrosine in Rats by Transplanted Tumors. Kenneth G. Scott and Robert S. Stone. Cancer **4**: 345–352, March 1951.

This paper records the fate of the radioactivity from thyroglobulin, thyroxin, diiodotyrosine, monoiodotyrosine, and inorganic iodine labeled with I^{131}, in the organs of normal and tumor-bearing animals. The fate of these compounds in normal animals is extensively presented by means of graphs and tables.

When iodotyrosines were administered to tumor-bearing rats, relatively large amounts were deposited in the tumor providing the total tumor mass was large. When the tumors were relatively small, the deposition per gram of tumor was much lower.

Inorganic iodine administered intravenously as I^{131} was not accumulated by the tumors to the same extent as was the diiodotyrosine. Although a relatively small number of animals were studied, a correlation between tumor uptake of I^{131} per gram of tumor and total tumor size was observed. No consistent correlation was observed, however, between tumor size and the uptake of I^{131}-tagged thyroglobulin by the tumor.

It was further noted that a small tumor mass can stimulate thyroid activity and that the same tumor, having grown larger, may cause a depressing effect upon the thyroid. The authors suggest that the point of action of the proteose-like material liberated by the tumor may be due, in part, to an alteration of the capillary blood supply to the thyroid and other organs.

It is pointed out that if it can be demonstrated that tumors of human origin take up diiodotyrosine in sufficient amounts, then the I^{131}-tagged material may serve as a useful tool in the diagnosis of cancer.

Six graphs; 2 tables.

DONALD S. CHILDS, JR., M.D.
Rochester, Minn.

Role of Erythrocyte in Blood Iodine Transport Using Radioiodine I^{131}. Joseph B. Boatman and Campbell Moses, with the technical assistance of Thomas R. Kendrick and Thomas F Newcomb. Am. J. Physiol. **164**: 783–785, March 1, 1951.

It has been shown with radioiodine *in vitro* that human erythrocytes may contain 40 per cent of an iodine load (Rall, Power, and Albert: Proc. Soc. Exper. Biol. &

Med. **74**: 460, 1950). The authors report a study of the distribution of erythrocyte iodine *in vivo* and its relation to the level of ingested radioiodine. Radioiodine was found to be present in the plasma and erythrocytes of the rat throughout a 24-hour period, with a small gain in the plasma and a small loss in the erythrocytes toward the end of that time. The percentage of blood radioiodine in the erythrocytes was found to be the same as the calculated percentage of the blood water in the erythrocytes. It is suggested that erythrocyte iodine was either in organic solution, or combined with a small protein molecule, freely diffusible in the normal animal.

Two tables.

EFFECTS OF RADIATION

Leukemia as a Possible Complication of Radiodermatitis. Francis W. Lynch. Arch. Dermat. & Syph. **63**: 503, April 1951.

The author reports a fatal case of leukemia in a patient with an extensive chronic radiodermatitis following roentgen therapy for psoriasis and for a cancer of the nose. In view of the greater incidence of leukemia among radiologists and dermatologists than among other physicians, the question is raised as to whether the frequently repeated treatments which produce radiodermatitis may also lead to the development of leukemia.

Pathogenesis and Treatment of the Postirradiation Syndrome. J. Garrott Allen, Peter V. Moulder, and Daniel M. Enerson. J. A. M. A. **145**: 704–711, March 10, 1951.

The authors studied dogs which had been given a standard total body exposure of 450 r. (The usual LD_{100} for dogs ranges between 300 r and 325 r.) The post-irradiation syndrome was characterized by hemorrhage, infection, anemia, and malnutrition. Hemorrhage was a serious problem, with bleeding occurring in almost all the animals. Thrombocytopenia, capillary injury, infection, and possibly denaturation of proteins are important contributors to this hemorrhagic pattern. In some animals the presence of a circulating anticoagulant was demonstrated. When present, its physiological action in some of the dogs resembled that of heparin and in some animals, hemorrhage responded partially and less often completely to the administration of toluidine blue and to a smaller extent to protamin sulfate. These agents are known to form salts with heparin and with a number of similar but less potent anticoagulants. To combat capillary hemorrhage in man, rutin and related substances, including ascorbic acid (vitamin C), have been advocated as effective agents and, since there is no completely effective antihemorrhagic program for irradiation hemorrhage, such agents should be given consideration. In the dogs studied, blood transfusion was without effect on bleeding and frequent transfusions exerted no effect on either the platelet or leukocyte counts of the recipients.

After lethal exposures to total body irradiation, infection frequently occurs, accounting for a large portion of deaths. Lethal or near lethal exposures may reduce temporarily the effectiveness of the immune mechanisms, both innate and acquired, until the organism's protective measures are too exhausted to cope with the infection. A study of the effect of passive transfer of antibodies was conducted with no significant difference in the survival of the treated and untreated dogs. Aureomycin hydrochloride showed some effect in treated dogs in that weight loss occurred later in these animals and, in general, the onset of serious clinical illness was delayed about six days, during which the animals continued to eat. However, there were no survivors in the group treated with aureomycin alone. Transfusion of whole blood combined with aureomycin was more beneficial. Two of the 11 animals so treated were living at eighty-two and ninety-six days.

Blood transfusion was the most effective therapeutic agent for correction of anemia. In man, its effectiveness may be implemented by the administration of a diet high in protein content, and supplemented by iron, liver, and possibly folic acid and vitamin B_{12}. The authors emphasize that marrow activity will recover, provided the irradiated individual can be carried through the period when infection and hemorrhage are serious hazards. In the acute phase of anemia in man, oxygen therapy should also be considered.

Except for the first day, most animals ate well for one to two weeks after exposure. Thereafter, diarrhea, anorexia, and vomiting occurred to an unpredictable degree and were associated with ulcerations and edema of the gastro-intestinal tract. Parenteral feeding was a necessity and was employed extensively when oral feeding became impossible. Of the parenteral agents, blood proved to be the most important. The effect of plasma was not studied but would undoubtedly be of value. In man, dextrose, saline solution and possibly the amino acid hydrolysates will be required to meet the fluid and caloric needs and to combat diarrhea and vomiting.

The authors stress that irradiation injury is a systemic disorder. Wounds, burns, and other injuries must be considered in the light of the entire body economy, for the careful management of local wounds is of little consequence if the subsequent general physiological disorders are not taken into consideration.

Six charts; 2 tables. WILLIAM H. SMITH, M.D.
University of Louisville

Adrenal Shielding and Survival of Rats After X-Irradiation. Abraham Edelmann. Am. J. Physiol. **165**: 57–60, April 1, 1951.

When lead shields were placed around the adrenal glands of rats, a decrease in the number of deaths following 700 or 800 r of whole body x-irradiation occurred. It was thought that shielding prevents direct radiation damage to the glandular cells so that they retain their ability to respond to non-specific stress. The gland was extruded from the shield after three months, probably because of the formation of connective tissue within the shield, and enucleation with degeneration of the medulla appeared to result.

It is thought that available histologic and histochemical technics do not reveal the true radiosensitivity of the adrenal cortex. S. F. THOMAS, M.D.
Palo Alto, Calif.

Effect of X-Radiation and Antihistamine Drugs on the Reticulo-Endothelial System Measured with Colloidal Radiogold. Jack Barrow, John L. Tullis, and F. W. Chambers, Jr. Am. J. Physiol. **164:** 822–831, March 1, 1951.

The function of phagocytosis by the reticulo-endothelial system was studied by determining radiometrically the rate of removal of colloidal gold, radioactive in tracer amounts, injected intravenously into normal rabbits and into rabbits variously treated with x-rays, thorotrast, antistine, pyribenzamine, and histamine. A marked variation in the rate of uptake of colloidal gold in apparently normal rabbits was noted. Thorotrast was observed to be capable of temporarily suppressing almost completely the removal of colloidal gold from the circulation. At no time following total body roentgen irradiation in amounts up to the LD 50/30 was the rate of gold sol uptake found to be significantly altered from the rate of uptake in untreated rabbits. Pre-treatment of normal and irradiated rabbits with antihistamine drugs and/or histamine did not alter the rate of phagocytosis of the gold colloid.

Four photomicrographs; 4 tables.

Mammary-Tumor Incidence in Female C3Hb Mice Following Long Continued Gamma Irradiation. Egon Lorenz, Allen B. Eschenbrenner, Walter E. Heston, and Delta Uphoff. J. Nat. Cancer Inst. **11:** 947–965, April 1951.

Mice of certain strains, assumed not to carry the milk agent, have a very low incidence of mammary tumors. On the other hand, mice which carry the milk agent have a tumor incidence that may reach 95 to 100 per cent. This report deals with the effects of irradiation on the mammary tumor incidence in agent-free (strain C3Hb) mice. Ninety-six female mice were used as experimental animals; 16 virgin females served as controls. The irradiated animals were exposed to gamma irradiation from a radium capsule at the rate of 1.1 r per hour. Exposure was given daily for eight hours, and continued until the animals died or were eventually sacrificed.

The mean-survival time for the experimental animals was 405 plus or minus 10 days and for the virgin controls 684 plus or minus 11 days. For a series of breeder controls being studied at the same time the figure was 576 plus or minus 11 days. These differences in mean-survival time are highly significant.

The mammary tumor incidence in the chronically irradiated mice was 47 per cent, with mammary carcinomas making up 20 per cent and sarcomas 30 per cent. Though this strain of mice is known to have a low incidence of lymphoid tumors, in the order of magnitude of a few per cent, a lymphoid tumor incidence of 36 per cent was found in the animals receiving irradiation under the conditions of the experiment. In addition, the incidence of ovarian tumors in these animals was found to be 88 per cent.

The following conclusions are drawn:

1. Chronic irradiation acts similarly to hormonal stimulation in that it increases the incidence of mammary tumors in agent-free mice.

2. Although the irradiated animals were virgins and became sterile, hormonal stimulation cannot be excluded as a causative factor in the genesis of the mammary tumor, because all mammary tumors were associated with a granulosa-cell tumor of the ovary.

3. The activation of a weak milk agent or destruction of an inhibitor by the irradiation seems unlikely, as tests failed to show the presence of an agent in the mammary tumor.

4. A direct effect of the chronic irradiation on the mammary gland alone seems also unlikely because chronic exposure of LAF_1 females to 0.11 r daily (8 hours) will elicit mammary sarcomas, although total accumulated doses did not amount to more than 80 to 150 r.

5. The mammary-tumor-inducing action of chronic whole-body irradiation may be caused by a combination of effects such as hormonal stimulation and direct effects upon the mammary gland or by other unknown effects of systemic origin.

Six photomicrographs; 4 graphs; 4 tables.

DONALD S. CHILDS, JR., M.D.
Rochester, Minn.

Quantitative Evaluation of Growth Rates in Tumors Before and After Radiation. Anna Goldfeder. Cancer Res. **11:** 169–173, March 1951.

An attempt was made to evaluate the rates of growth of tumors before and after radiation on a quantitative biological basis, employing Chalkley's method (J. Nat. Cancer Inst. **4:** 47, 1943–44), which permits a quantitative evaluation of spatial distribution of morphologic tissue components in an extended volume of tissue. Two mammary tumors, dbrB and C3H, both diagnosed as adenocarcinomas, were used for the investigation.

In preliminary studies the average ratio of mitotic to resting cells for the dbrB tumor was found to be 1:49.6, and for the C3H tumor 1:72.5. The dbrB tumor was found to increase in size most rapidly between the fifth and fifteenth day following implantation of the tumor, while in the C3H tumor the greatest increase in size occurred within three or four weeks. The satisfactory results obtained from the evaluation of growth activity of non-irradiated tumors by the use of Chalkley's method prompted its application to the study of irradiated tumors. The dbrB tumor was selected for use in this experiment because of its more uniform rate of growth.

Volume ratios of mitotic to intact resting cells of 5 dbrB tumors exposed to various doses of x-radiation, from 5,000 to 16,000 r, and removed following various periods, are presented. Microscopic fields of stained sections of intact portions of the tumor, chosen at random, were used for analysis. A decrease in mitotic activity was observed which depended upon the dose of irradiation applied and the lapse of time between exposure and removal of the tumors. For example, 1 mitotic figure to 41.0 resting cells was found in the intact portions of a dbrB tumor twenty-four hours following a dose of 5,000 r; a ratio of 1:87.5 was found in another dbrB tumor which received the same dose of radiation but which was removed thirteen days following exposure. A delayed effect is indicated.

The effectiveness of a large dose of radiation is illustrated by the ratio of 1 mitotic figure to 350 resting cells found in a dbrB tumor which was removed and fixed twenty-two hours following irradiation with 16,000 r.

The results obtained indicate the possibility of applying Chalkley's method to the quantitative evaluation of growth rates of tumors, taking the mitotic index as a criterion. This method also proved helpful in evaluating the effectiveness of a given dose of radiation on a quantitative basis.

Two illustrations; 3 tables.

Changes in Cell Morphology and Histochemistry of the Testis Following Irradiation and Their Relation to Other Induced Testicular Changes. I. Quantitative Random Sampling of Germinal Cells at Intervals Following Direct Irradiation. Lloyd C. Fogg and Russell F. Cowing. Cancer Res. 11: 23–28, January 1951.

The purpose of the investigation reported in this paper was to study the effects of direct x-radiation in the testis, with special concern for fundamental problems of growth, regeneration, and differential response of cellular elements, in the hope that this would contribute to the knowledge of neoplasia.

Testes of 104 pure-line C57 black adult mice, weighing 18–25 gm., were subjected to a single exposure of 300 r, with the following factors: 100 kv.p., 15 ma., 2.6 mm. Al h.v.l., 187 r per minute, target-skin distance 20 cm. One hundred other animals were given a single total-body exposure of 300 r without shielding.

The evaluation of radiation effects was based on a quantitative random sampling of the germinal elements of the testis, quantitated with respect to frequency of cell population types plotted against time after irradiation.

A small percentage of all germinal elements was found to persist after a dose of 300 r. The period of least frequency of spermatocytes was around fourteen days; that of spermatids and sperm, twenty-eight days. The data indicate that it takes twenty-one to twenty-two days for a gonium to develop into sperm.

The slopes of the curves in terms of time and progressive loss of each of the germinal elements were roughly the same. This suggests that each of the germinal elements is affected to the same degree but at different intervals.

The period of greatest biological variation is from ten to twenty-eight days for each of the four germinal elements.

A single dose of 300 r does not cause the disappearance of Sertoli cells or hyperplasia of the interstitial cells, nor was connective tissue visibly affected in the twelve-week interval included in the study.

Four charts; 5 photomicrographs.

Changes in Cell Morphology and Histochemistry of the Testis Following Irradiation and Their Relation to Other Induced Testicular Changes. II. Comparison of Effects of Doses of 1,440 r and 5,050 r with 300 r. Lloyd C. Fogg and Russell F. Cowing. Cancer Res. 11: 81–86, February 1951.

In a continuation of the investigation described in the preceding abstract, the testes of 78 mice were subjected to a single exposure of 1,440 r and 74 other animals were given a single dose of 5,050 r. These doses were chosen because it was hoped that the dosage necessary to cause permanent loss of all the germinal elements would be somewhere between these levels.

Whereas 300 r destroys roughly 90 per cent of the germinal elements, 1,440 r destroys 97–98 per cent, and a single dose of 5,050 r goes beyond the necessary level for complete lysis of the germinal cells, excluding the Sertoli cells. From this work it might be estimated that a dose in the range of 2,000 r would be the minimal dose level for destruction of germinal elements.

In comparison to 300 r, it is indicated that a single dose of 1,440 r further reduces the frequency of the appearance of the germinal cells and delays the time of recovery for spermatogonia and spermatocytes. There is also less evidence of numerical variation in the spermatogonia and spermatocytes and there are less marked peaks and depressions in the figures.

An acute dose of 5,050 r destroys all the germinal elements, but all these elements do not disappear at the same time. The gonia disappear first, followed by the spermatocytes, spermatids, and sperm.

Once each of the types of germinal elements starts to disappear, the rate is approximately the same, regardless of the dose.

The degree of injury is relative to the magnitude of the dose.

Eight charts; 1 table.

Differential Effects of Roentgen Rays on Cell Permeability and on Cell Cleavage. Experiments with Egg Cells of Arbacia Punctulata. Balduin Lucké, Renato A. Ricca, and Arthur K. Parpart. J. Nat. Cancer Inst. 11: 1007–1023, April 1951.

Many radiobiologists believe that the exposure of living cells to roentgen rays or to other forms of irradiation leads to changes in cell permeability, and that to such changes in permeability may be attributed, in part at least, the injurious effects of ionizing radiation on neoplastic as well as on normal cells.

The present paper deals with the action of roentgen rays on permeability of unfertilized *Arbacia* (sea urchin) eggs. In particular, the more or less immediate rather than the late effects were studied following exposure of these cells to 100,000 r delivered at a rate of 7,190 r per minute from a tube operated at 182 kv. with 0.15 mm. copper equivalent filter. Permeability values were obtained for water, for ethylene glycol, and for diethylene glycol. It was found in each instance that the irradiated cells did not differ in permeability values from the control cells. However, that the irradiation proved injurious to the cells was shown, for, after fertilization, cleavage was delayed and atypical, and later the cells cytolyzed.

The effect of the radiation was thus found to be differential with respect to two functions of the cells, namely cleavage and permeability. Such a differential effect is not unique for irradiation but is similar to the action of certain other factors, such as some carcinogens and heavy water. These results are discussed with respect to their bearing on the general biological concept of injury.

Five illustrations; 4 tables.

DONALD S. CHILDS, JR., M.D.
Rochester, Minn.

Effect of Roentgen-Ray Radiation on the Biosynthesis of Nucleic Acids and Nucleic Acid Purines. Howard E. Skipper and Jack H. Mitchell, Jr. Cancer 4: 363–366, March 1951.

This report is a continuation of the investigations of the effects of known anti-cancer agents on nucleic acid metabolism with particular reference to roentgen-ray radiation. Hevesy had previously observed that roentgen radiation inhibits the incorporation of C^{14} into desoxyribosenucleic acid purines (Nature **163**: 869, 1949). These experiments repeat those of Hevesy, but with the use of radioactive carbon dioxide ($C^{14}O_2$) as the precursor of the purine carbon. In addition, attempts were made to reverse the roentgen-induced nucleic acid inhibition by means of glutathione.

Roentgen radiation (950 r) was shown to inhibit the

incorporation of radioactive carbon from bicarbonate and formate into nucleic acids and nucleic acid purines over a period of six hours. Glutathione had no apparent effect on the radiation-induced nucleic acid inhibition.

Two tables. DONALD S. CHILDS, JR., M.D.
Rochester, Minn.

On the Regular and Constant Behavior Pattern of the Flocculation Test Following Roentgen Irradiation in Man. Maki Takata. Radiol. clin. **20**: 21–33, January 1951. (In German)

The laws governing ionization of gases and air are well known. We know much less, however, about the ionization taking place in living tissues, which the author calls "Vitalionization."

Takata in 1935 developed a new method for the determination of a radiation dose: 5 c.c. of blood are withdrawn during irradiation from the cubital vein every five to ten minutes and the flocculation number is determined by an ion-titration method. [This method, as described in Helvet. med. Acta **17**: 254, 1935, is in principle a quantitative test which determines the change of protein and γ globulin concentration of the blood serum. It is not a specific test, having first been used to determine the day of ovulation. The test varies greatly during a given year. Regular variations have also been observed within a ten-year period since 1935, presumably due to "sun rays." Different concentrations of the "Takata solution" (a mixture of equal portions of 0.5 per cent sublimate solution and 0.02 per cent fuchsin) are added to the serum sample and the flocculation is observed by the eye against a 100-watt lamp.]

The "Vitalionization" produced by ionizing rays in living tissues has a different behavior pattern than air ionization. Takata believes that the Compton effect is of greater importance in the living tissues than the photoelectric effect. The biological effect of roentgen rays is not a direct effect of a radiation quantum, but the effect of secondary or tertiary electrons.

The results of experiments dealing with the determination of the Vitalionization (J′) in relation to radiation intensity, quality and volume are given in detail; also comparative data between J′ and r with hard and soft rays are reported. The experiments have demonstrated a regular and constant behavior pattern of the flocculation test with hard rays.

Only rays smaller than 0.1 Å cause Vitalionization; soft rays do not. In other words, Vitalionization expressed in J′ is wavelength-dependent.

The author summarizes his paper with the statement that the magnitude of the flocculation figure varies with the Vitalionization caused by the irradiation. It depends on the dose of radiation and the wavelength. He adds that the human organism can be used as an object for the biological test of Vitalionization.

Eight charts; 1 table.

EUGENE F. LUTTERBECK, M.D.
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The Physician's Task in the Atomic Explosion. Heinz Richard Landman. Rocky Mountain M. J. **48**: 177–183, March 1951.

Like other writers on the subject of atomic explosion, the author considers thermal, blast, and radiation effects. The thermal effect is instantaneous and results in flash-burn casualties up to about two and one-half miles; severe third degree burns will probably result up to one mile. Flash burns are, however, prevented by a minimum amount of shielding. Burns will occur only on those parts of the body exposed to the source of the flash. Light clothing with its reflecting power gives much better protection than the absorptive dark clothing. Temporary blindness from looking at the flash will occur out to a distance of ten miles; permanent injury to the eyes due to the flash was not frequently observed in Japan.

The blast rarely causes serious internal injury. In an atomic explosion, due to thermal updraft, there is a terrific backrush of air opposite to the direction of the original blast. This will not only fan secondary fires but also hurdle debris toward the point of detonation.

The author discusses radiation effects at great length. He notes that there is little likelihood that there will be casualties from the direct alpha and beta radiation, since these particles have a short range and any individual close enough to their effective range would have succumbed to the thermal effects. The gamma rays in the emissions from the fission products rising in the atomic cloud are damaging because of their greater range. Neutrons, which appear only during the actual bomb explosion, are an additional radiation hazard. Though their range is only about 1,000 yards, they penetrate even reinforced concrete.

From the experiences in Japan it is known that only 15 per cent of the casualties are due to radiation effect and that it is safe under certain conditions to enter a bombed area after about ninety seconds. The public must be told of these figures so that all effort can be made to extinguish fires and evacuate the wounded.

The author goes on to discuss the genesis of radiation injury, discussing ionization, internal radiation, and external radiation. Internal radiation is caused by radioactive substances entering the body by ingestion, inhalation, or through a break in the skin. The alpha particles are the most dangerous because of their high ionizing potential. The symptomatology of those subjected to moderate and lethal doses of radiation is covered, as is the treatment of acute radiation sickness. The latter is almost entirely supportive. Also discussed are the methods for determining residual radiation, protection of personnel entering danger zones, decontamination of personnel, foods, etc.

The paper closes with the reminder that the physician's task is more than just treating casualties. "He has the confidence of the public and he is well equipped to allay exaggerated fears, to work closely with civilian defense officials in the proper planning and execution of workable defense plans." BERTRAM LEVIN, M.D.
Chicago, Ill.

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